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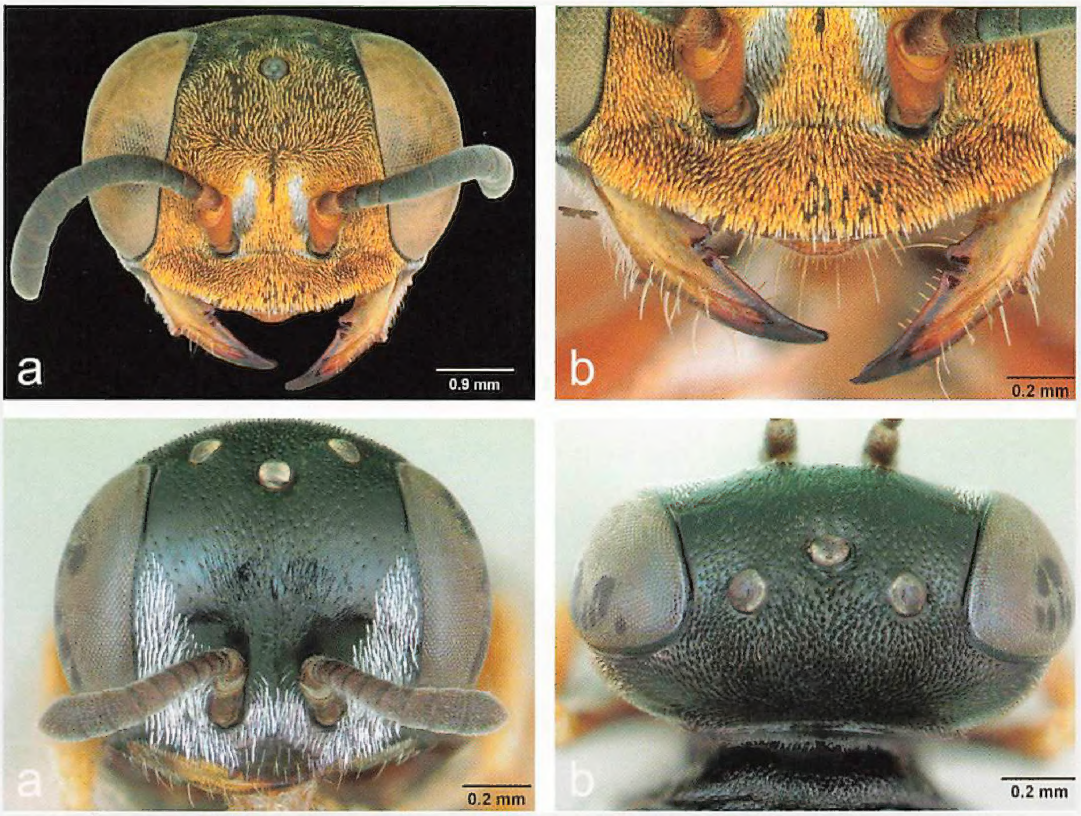

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COVER IMAGE

"Beauty, it is said, is in the eyes of the beholder!"

FIGURE 37 (above). *Sericophorus chrysophorus* Pulawski, sp. nov.: a – female head in frontal view; b – female clypeus in frontal view

FIGURE 149 (below). *Sericophorus pectinatus* Lomholdt, sp. nov.: a – female head in frontal view; b – female head in dorsal view

For details see:

Ole Lomholdt and Wojciech J. Pulawski: A Revision of the Wasp Genus *Sericophorus* F. Smith, 1851 (Hymenoptera: Apoidea: Crabronidae)

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PROCEEDINGS OF THE CALIFORNIA ACADEMY OF SCIENCES

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A Revision of the Wasp Genus *Sericophorus* F. Smith, 1851 (Hymenoptera: Apoidea: Crabronidae)

†Ole Lomholdt and Wojciech J. Pulawski[1]

[1]*California Academy of Sciences, Golden Gate Park, San Francisco, California 94118, USA*
E-mail: wpulawski@calacademy.org

The genus *Sericophorus* F. Smith is revised, a key to the species is provided, and a cladistic analysis (based on morphological characters solely) is performed. The genus *Zoyphidium* Pate (= *Zoyphium* Kohl, 1893, nec Agassiz, 1847), treated as a subgenus of *Sericophorus* by Bohart and Menke, 1976, is here synonymized with *Sericophorus*. The following 33 are new species by Lomholdt: *albitarsis* (Australia), *argentifacies* (Australia), *aurifrons* (Australia), *axillaris* (Australia), *cardaleae* (Australia), *confusus* (Australia), *cornutus* (Australia), *evansi* (Australia), *fissus* (Australia), *glossatus* (Australia), *halli* (Papua New Guinea), *houstoni* (Australia), *laticeps* (Australia), *lissonotus* (Australia), *mandibularis* (Australia), *nasicornis* (Australia), *nigrescens* (Australia), *nigripes* (Australia), *pectinatus* (Australia), *politus* (Australia), *protrudens* (Australia), *ruficollis* (Australia), *rufithorax* (Australia), *sabulosus* (Australia), *sanguineus* (Australia), *setulosus* (Australia), *subalaris* (Papua New Guinea), *triangularis* (Australia), *vicarius* (Australia), *viridescens* (Australia), *wheeleri* (Australia), and *xanthogaster* (Australia), and the following 29 by Pulawski: *ambonensis* (Ambon Island), *arrernte* (Australia), *barakula* (Australia), *bicellularis* (Australia), *centralis* (Australia), *chrysophorus* (Australia), *deserticola* (Australia), *flavipes* (Australia), *flavorufoniger* (Australia), *genalis* (Australia), *glaucus* (Australia), *glyptus* (Australia), *karrathensis* (Australia), *kurandae* (Australia), *maculatus* (Australia), *mesopleuralis* (Australia), *mimus* (Australia), *minys* (Australia), *multipictus* (Australia), *nasutus* (Australia), *nitidus* (Australia), *papuanus* (Papua New Guinea), *punctatum* (Australia), *riparius* (Australia), *rufus* (Australia), *scintillans* (Australia), *sparsus* (Australia), *tibialis* (Australia), *trichocephalus* (Australia), and *xanthomelas* (Australia). Two of these species, *centralis* and *kurandae*, are described in the Appendix.

The following new synonyms have been established by Lomholdt (the valid name is listed last): *Sericophorus brisbanensis* Rayment, 1955, *Sericophorus castaneus* Rayment, 1955, *Sericophorus hackeri* Rayment, 1955, and *Sericophorus cockerelli* Menke (in Bohart and Menke), 1976 = *Sericophorus bicolor* F. Smith, 1873; *Sericophorus inornatus* Rayment, 1955, *Sericophorus lilacinus* Rayment, 1955, *Sericophorus rufipes* Rayment, 1955, *Sericophorus sculpturatus* Rayment, 1955, *Sericophorus subviridis* Rayment, 1955, *Sericophorus sydneyi* Rayment, 1955, *Sericophorus victoriensis* Rayment, 1955, and *Sericophorus raymenti* Menke (in Bohart and Menke), 1976 = *Sericophorus chalybeus* F. Smith, 1851; *Sericophorus cyanophilus* Rayment, 1955, *Sericophorus chalybaeus* [sic] *fulleri* Rayment, 1955, *Sericophorus gracilis* Rayment, 1955, and *Sericophorus rufotibialis* Rayment, 1955 = *Sericophorus cliffordi* Rayment, 1955; *Zoyphium hackeri* Cockerell, 1932 = *Sericophorus dipteroides* Turner, 1907; *Sericophorus pescotti* Rayment, 1955 = *Sericophorus froggatti* Rayment, 1955;

***Zoyphium humile* Cockerell, 1932 = *Sericophorus funebris* Turner, 1907; *Zoyphium fuscipenne* Hacker and Cockerell, 1922 = *Sericophorus iridipennis* (Turner, 1914); *Sericophorus patongensis* Rayment, 1955 and *Sericophorus rugosus* Rayment, 1955 = *Sericophorus metallescens* Rayment, 1955; *Zoyphidium rufipes* Rohwer, 1911, *Sericophorus carinatus* Rayment, 1955, *Sericophorus relucens nigricornis* Rayment, 1955, *Sericophorus relucens ruficornis* Rayment, 1955, and *Sericophorus rufobasalis* Rayment, 1955 = *Sericophorus relucens* F. Smith, 1856; *Anacrucis cingulata* Rayment, 1955 and *Anacrucis ferruginea* Rayment, 1955 = *Sericophorus splendidus* (Hacker and Cockerell, 1922); *Tachyrrhostus* [*sic*] *claviger* Kohl, 1892, *Sericophorus claviger burnsiellus* Rayment, 1955, *Sericophorus elegantior* Rayment, 1955, *Sericophorus occidentalis* Rayment, 1955, *Sericophorus spryi* Rayment, 1955, *Sericophorus tallongensis* Rayment, 1955, *Sericophorus teliferopodus* Rayment, 1955, *Sericophorus teliferopodus okiellus* Rayment, 1955, *Sericophorus viridis roddi* Rayment, 1955, and *Sericophorus violaceus* Rayment, 1955 = *Sericophorus viridis* de Saussure, 1854; and the following one by Pulawski: *Anacrucis punctuosa* Rayment, 1955 = *Sericophorus froggatti* Rayment, 1955. A neotype for *Sericophorus rufobasalis* Rayment, 1955 is designated by Pulawski.**

Preface

This paper was initiated by Ole Lomholdt in the early 1980s, but left unfinished because of his prolonged illness and untimely death. I reviewed an earlier version of the manuscript in 1982, and both Arnold S. Menke and myself reviewed an updated version (dated 22 March 1988) in 1990. We agreed that it was not publishable. In 1991, following Arnold's suggestion, Ole proposed to Borge Petersen that I coauthor the paper (Borge's letter of 22 April 1991), and I agreed. My other projects made it impossible for me to work on this one until 2007.

Subsequently, Lars Vilhelmsen of the Copenhagen Museum kindly sent me Ole's manuscript, his original illustrations, and most of the specimens he studied. David Furth (Smithsonian Institution), Terry F. Houston (West Australian Museum), Philip D. Perkins (Museum of Comparative Zoology), and Kenneth L. Walker (National Museum of Victoria) sent the remaining specimens examined by Ole. Thus I was able to carefully compare them with his original descriptions.

Ole's observations, as recorded in his descriptions, were sound and practically error-free. In particular, he correctly recognized all the species he treated and the synonymies, and he found a number of previously unknown characters to differentiate the species. His manuscript, however, required a great deal of work as almost every line had to be rewritten. The synonymies and descriptions had to be tightened and reorganized, inconsistencies and some redundancies removed, many missing details added (e.g., the collectors names in the descriptions of new species), subjective terms corrected, some awkward English improved, locality records alphabetized, and literature cited updated. I have also completely rewritten the key and the diagnoses, added a number of previously unnoticed characters, conducted fieldwork in Australia in 2006, 2007, and 2008 (although with limited success), studied 1,075 additional specimens (nearly all from additional localities), described 29 species unknown to Ole, generated illustrations using Automontage, added distribution maps, and conducted a cladistic analysis.

All the new species and new synonymies recognized by Ole are credited to him.

Wojciech J. Pulawski

Ole Carsten Lomholdt (8 May 1946–9 February 1999): A Biographic Sketch

Based on a translation from Danish by Lars Vilhelmsen of the Obituary by Henrik Enghoff, 1999

Ole was the son of lawyer Knud Lomholdt and nurse Brigitte Lomholdt (neé Maas). After his graduation from a public school in 1962, he came to the Zoological Museum, Copenhagen, as an apprentice taxidermist, but the year after he initiated studies on Jonstrup Seminarium to become a school teacher. He completed his studies and worked for a short time as a teacher in Mårum, northern Zealand. In 1967 he was matriculated as a biology student at Copenhagen University (on dispensation, as he did not have a high school degree). From the beginning he was associated with the Zoological Museum, which was already familiar to him.

Ole's entomological interests initially focused on butterflies and beetles, but soon digger wasps became his main passion, and he made them the subject of his professional career.

In the late 60s the entomological department of he Zoological Museum had a vibrant student community, Ole being one of the key persons. First and foremost he was an excellent entomologist. He knew Danish insects, especially Hymenoptera, better than most, and he had a keen eye for behaviour and life history. Apart from entomology, Ole was also more gifted with creativity and practical skills than most people. During frequent excursions at home and abroad, Ole was the one who knew how to keep the car running or fry fish on a fire. His artistic abilities, displayed in music, ceramics, and the writing of songs, made him a breath of fresh air at the Museum.

While doing his coursework Ole worked steadily on his exceptionally ambitious Master's thesis: a revision of the sphecids of the Scandinavian countries. The thesis was completed in 1975 and 'The Sphecidae of Fennoscandia and Denmark' was published (1975–1976) in two volumes in the newly started series 'Fauna Entomologica Scandinavica'. This was to be his main contribution; it is extremely thorough and contains numerous detailed illustrations by the author. It is still very useful and was reprinted in 1984, a rare honour for an entomological publication.

After his Master's degree Ole secured a grant for obtaining the Lic. Scient. degree (the precursor and equivalent of the Ph.D. degree). The subject of this thesis was a comprehensive phylogenetic analysis of the subfamily Larrinae, with emphasis on the tribe Miscophini of southern Africa and Madagascar. The degree was awarded in 1980, and the thesis published in 1985. It deals with 59 species and contained descriptions of 25 new species, one new subgenus, and one new genus

Meanwhile, the head of department, Ole Tuxen, had retired from the Department of Entomology in 1978, and an associate professorship was advertised. Ole got the position in tough competition with the somewhat younger Ebbe Smith Nielsen (who subsequently became a director of the Australian National Insect Collection). As the Department already had a curator for Hymenoptera, Børge Petersen, Ole was made responsible for Coleoptera, but he continued his research on Sphecidae. However, he was no stranger to beetles as he had an early interest in them; his first, small, publication is actually on a beetle.

During his time as assistant professor and from 1980 as associate professor, Ole continued to explore exotic Sphecidae. In 1980, he described the new genus *Aulacophilinus* from Rennel Island, and the first female of the little known Australian genus *Aha*. In 1983, he published a revision of the Australian genus *Sphodrotes* (with a section on phylogeny) and he started working on the Australian genus *Sericophorus*, a project that he was unable to finish. He discussed the origin of bees in a phylogenetic context in a publication from 1982. He advocated the idea that the closest rela-

tives of bees are within the Sphecidae, rendering the latter paraphyletic; this viewpoint is universally accepted now. He also published numerous short papers on Danish ants, bees, and wasps.

The theoretical aspects of entomology never became Ole's main interest; taxonomy, faunal studies, and not least field work had a far more lasting appeal. He was unsurpassed in the field and probably never happier than when struggling through difficult terrain in pursuit of sphecids and other insects, clad only in shorts and flip-flops and armed with a sweep net. His fellow travellers usually had to spend the evenings removing murderous *Acacia* thorns, etc., from his feet.

Ole's fieldwork in Denmark included trips to Læsø, Anholt, Hesselø and Fyn, usually in company of fellow entomologists of the same age or by other zoologists. He also visited Tanzania (several times), Namibia (1978), Thailand (1981), and Madeira (several times). It is characteristic of Ole's feel for small critters that he provided his colleague Henrik Enghoff with endemic millipedes from Madeira that got him started on this subject (in his own words, Mr. Enghoff had gone to the island shortly before without finding any of these species).

He also had a life outside his career. Ole was married in 1978 to Anne Grethe Randrup, and they had a son, Chrisitian, in 1979. The marriage was dissolved in 1983, and his employment did not last either. He never really settled into his position as a permanent employee at the Zoological Museum. Maybe the restrictions imposed by a permanent job did not agree with his temperament; maybe his outlook was too different from his colleagues; maybe both in combination or something entirely different. Whatever the cause, eventually his long-lasting addiction to alcohol got out of hand, and he had to leave his position in 1990. He moved to his beloved summer residence at Tibirke, and the contact with the museum petered out. The news of his death was sad, but perhaps not unexpected.

Technical Terms

Most of the morphological terms are as in Bohart and Menke (1976). The few not included in their work are defined below:

Clypeal lamella: the most ventral, unsculptured part of middle clypeal section, adjacent to lobe free margin.
Episcrobal area: the portion of the mesopleuron above the scrobal groove and below the subalar fossa (from Budrys, 1990, 1993). Bohart and Menke (1976) called it hypoepimeral area, a morphologically inaccurate term meaning "area under the epimeron".
Humeral plate: a sclerotized plate located basad of the origin of the costal and subcostal veins of the forewing and partly covered by the tegula.
Orbital fovea: a slightly impressed, longitudinal area adjacent to eye orbit at the level of hindocellus.
Scutal flange (e. g., Bohart and Menke, 1976:409, 453; Menke, 1988): a curving lateral scutal carina that borders the tegula. Called parascutal carina by Tulloch (1935), Gibson (1985), and Ronquist and Nordlander (1989).
Scutum: shortened term for mesoscutum.
Tergum (terga): an abbreviated term for gastral tergum (terga).

Origin of Material

This paper is based mainly on the material kindly sent by the institutions listed below and only partly on the specimens collected by W. Pulawski in Australia. The contact person name is given in parentheses:

AEI: American Entomological Institute, Gainesville, Florida, USA (David B. Wahl).
AMNH: American Museum of Natural History, New York, New York, USA (John S. Ascher).
AMS: Australian Museum, Sydney, Australia (G.A. Holloway, David Britton).

ANIC: Australian National Insect Collection (CSIRO); Canberra, Australia (Ian D. Naumann, Josephine C. Cardale, John LaSalle, Nicole Fisher).

BCRI: Biological and Chemical Research Institute, Ryndalmere, Australia (G.R. Brown), currently Orange Agricultural Institute, New South Wales Agricultural Scientific Collections Unit, Orange, New South Wales, Australia.

BISH: Bernice P. Bishop Museum, Honolulu, Hawaii, USA (Shepherd Myers, Gordon M. Nishida).

BMNH: The Natural History Museum (formerly British Museum Natural History); London, United Kingdom (Colin R. Vardy, George R. Else, David G. Notton).

CAS: California Academy of Sciences, San Francisco, California, USA.

CU: Cornell University, Ithaca, New York, USA (the late George C. Eickwort).

FSCA: Florida State Collection of Arthropods, Gainesville, Florida, USA (James R. Wiley).

INHS: Illinois Natural History Survey, Champaign, Illinois, USA (Colin Favret).

MCZ: Museum of Comparative Zoology, Harvard, USA (Margaret K. Thayer, Stefan Cover).

MNHN: Muséum National d'Histoire Naturelle, Paris, France.

MHNG: Musée d'Histoire Naturelle, Genève, Switzerland (Claude Besuchet).

NMV: National Museum of Victoria, Melbourne, Australia (A. Neboiss, Kenneth L. Walker, Catriona McPhee).

NTM: Museum and Art Gallery of the Northern Territory, Darwin, Australia (Gavin Dally).

QMB: Queensland Museum, Brisbane, Australia (E.C. Dahms, G. Thompson).

RMNHL: Nationaal Naturhistorsch Museum (formerly Rijksmuseum van Natuurlijke Historie), Leiden, the Netherlands (Kees van Achterberg, Robert de Vries).

SAM: South Australian Museum, Adelaide, Australia (Eric G. Matthews).

UCD: University of California Davis, Davis, California, USA (Steven L. Heydon).

USNM: United States National Museum of Natural History, Washington, D.C., USA (Arnold S. Menke, David Furth, Brian Harris).

UQIC: University of Queensland Insect Collection, Brisbane, Australia (Margaret Schneider, Greg Daniels).

USU: Utah State University, Logan, Utah (Terry L. Griswold, Frank D. Parker).

WAMP: Western Australian Museum, Perth, Australia (Terry F. Houston).

ZMUC: Zoological Museum, University of Copenhagen, Copenhagen, Denmark (Borge Petersen, Lars Vilhelmsen).

ZMHU: Zoologisches Museum der Humboldt Universität, currently Museum für Naturkunde, Institut für Systematische Zoologie, Berlin, Germany (Frank Koch, Michael Ohl).

Genus *Sericophorus* F. Smith

Sericophorus Shuckard, 1840:181. Nomen nudum.

Sericophorus F. Smith, 1851:32. Type species: *Sericophorus chalybeus* F. Smith, 1851, by monotypy.

Tachyrrhostus de Saussure, 1854:69. Type species: *Tachyrrhostus cyaneus* de Saussure, 1854 [= *Sericophorus chalybeus* F. Smith, 1851], designated by Pate, 1937:63. Synonymized with *Sericophorus* by F. Smith, 1856:356.

Zoyphium Kohl, 1893:569, junior homonym of *Zoyphium* Agassiz, 1847, an emendation of *Zuphium* Latreille, 1806. Type species: *Zoyphium sericeum* Kohl, 1893, by monotypy. Reduced to subgenus by Menke *in* Bohart and Menke, 1976:44 and 301. **New synonym.**

Zoyphidium Pate, 1937:68. Substitute name for *Zoyphium* Kohl, 1893.

Anacrucis Rayment, 1955a:55. Type species: *Anacrucis laevigata* Rayment, 1955, by original designation. Synonymized with *Sericophorus* (*Zoyphidium*) by Menke *in* Bohart and Menke, 1976:44.

GENERIC DIAGNOSIS.— Bohart and Menke (1976) placed *Sericophorus* in Miscophini because of a round, non-modified hindocellus and the simply attenuate hindfemur (both characters are clearly plesiomorphic). Lomholdt (1985), however, assigned it, together with *Larrisson*, to Sericophorini because of a conspicuously narrowed anteriorly but not petiolate second submarginal cell (actually, it is broad anteriorly in *frontalis* and slightly petiolate in some *subalaris*). Menke (1977) included *Sericophorus* in his key to Miscophini, but the discovery of *Sericophorus bicellularis, centralis*, *genalis*, *politus*, and *subalaris* renders his key obsolete. There is not a single unique character by which all species of the genus can be recognized. The best is the presence of a well-defined median carina in the ventral third or so on the posterior propodeal surface (just below the median sulcus), a character not observed so far. The carina, however, is only one quarter of the posterior surface long in the holotype of *centralis*, and absent in the paratype. The carina is also present in *Lyroda* and *Sphodrotes*. The following are subsidiary recognition features: the occipital carina reaches the hypostomal carina in most species (does not reach in *centralis*, *genalis* and *politus*); three submarginal cells present in most species (two in *bicellularis* and *frontalis*); second submarginal cell markedly narrowing anterad except secondarily broad anteriorly in *frontalis* (a result of its merging with third submarginal cell), triangular in many species, slightly petiolate in some *subalaris*; propodeal spiracle in most species elongate, extending nearly to propodeal foremargin (Fig. 1); female with a setose pygidial plate; and presence of only 10 flagellomeres and absence of a volsella in the male.

TAXONOMIC HISTORY.— F. Smith (1851) established *Sericophorus* for one species (*chalybeus*), and described *relucens* in 1856 and *bicolor* in 1873. De Saussure (1854) proposed the genus

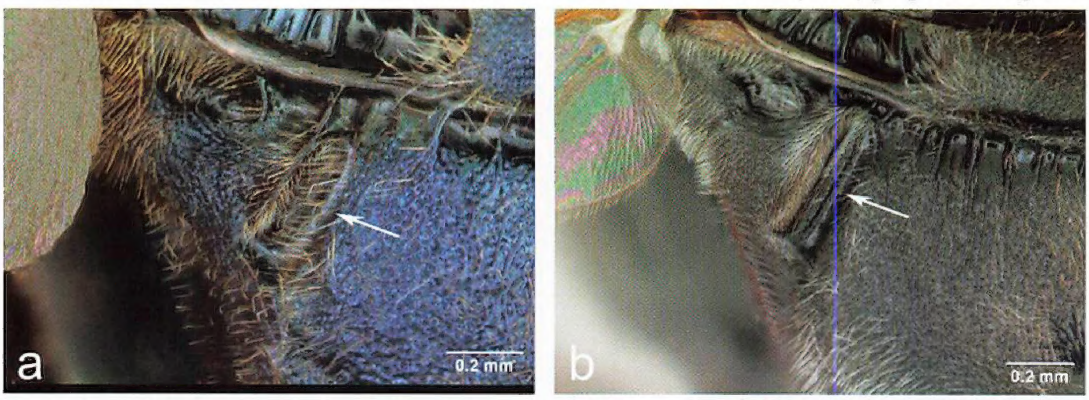

FIGURE 1. Propodeal spiracle of *Sericophorus*: a – *Sericophorus cliffordi* Rayment; b – *Sericophorus striatulus* (Rayment).

Tachyrrhostus (for his new species *viridis* and *cyaneus*) that was synonymized with *Sericophorus* by F. Smith (1856). Obviously unaware of this synonymy, Kohl (1892) described in *Tachyrrhostus* a new species, *claviger* (now known to be a synonym of *viridis*), and in 1893 he described *Zoyphium* (a junior homonym of *Zoyphium* Agassiz, 1847, renamed *Zoyphidium* by Pate, 1937), for his new species *sericeus*. Dalla Torre (1897) created a subfamily Sericophorinae for *Sericophorus* and *Zoyphium* that was regarded as a synonym of Miscophini by Bohart and Menke (1976) but recognized as a tribe within Larrinae by Lomholdt (1985). In most of the XXth century *Sericophorus* and *Zoyphidium* were treated as separate, but *Zoyphidium* was downgraded to a subgenus of *Sericophorus* by Menke *in* Bohart and Menke (1976). Turner (1907, 1908, 1912, 1914, 1916, 1936) described four species in *Sericophorus* and eight in *Zoyphium*, and in 1914 he produced revisions of both genera (Menke, 1967, established a separate genus, *Larrisson*, for one of Turner's species, *Sericophorus abnormis*). Additional species were described by Cockerell (1914, 1932), Rohwer (1914), and Hacker and Cockerell (1922). In 1955, Rayment published what amounts to a travesty of a revision of Sericophorini. He ignored previous work of the XXth century authors and did not study any of their types. His descriptions were done in a rambling conversational style that makes it difficult to separate facts from fantasy. Of the two new genera he established, one (*Anacrucis*) was synonymized with *Zoyphidium* by Menke *in* Bohart and Menke (1976), the other (*Astaurus*) with *Clitemnestra* by Bohart *in* Bohart and Menke (1976). Of his 40 new species and six subspecies, 33 are junior synonyms.

Earlier classifications.— Kohl (1893) differentiated his new genus *Zoyphium* (i.e., *Zoyphidium* Pate) from *Tachyrrhostus* (i.e., *Sericophorus*) by its acuminate marginal cell (narrowly truncate in *Sericophorus*). Turner (1914) recognized these two genera based on the same difference, although he questioned whether they could be kept apart. Cockerell (1932) was of the opinion that "the character, though rather insignificant, does serve to distinguish the genera without fail". He also analyzed other details of the wing venation, but concluded that they were too variable to be useful in classification. Bohart and Menke (1976) thought that "*Zoyphidium* is at most a subgenus of *Sericophorus*" and provided a key to their discrimination. The key was based on four characters: 1) shape of the marginal cell, 2) presence of lateral carina on the propodeum, 3) shape of the median sulcus of the propodeal dorsum, and 4) position of forewing vein M in relation to cu-a. Only the first character was considered reliable, whereas the other three were qualified with the term "usually", indicating "rather tenuous differences". According to my observations, however, the shape of the marginal cell is not stable either, being acuminate in some *houstoni* and narrowly truncate in others; in *funebris*, it is hard to decide what shape the cell is (some specimens appear to be minimally truncate, and some acuminate). My cladistic analysis of the genus clearly demonstrates that the genus cannot be subdivided at this time. Consequently, I synonymize *Zoyphidium* with *Sericophorus*.

Scarcity of material.— One serious hindrance with the study of *Sericophorus* is the scarcity of material. Of the 100 species recognized in this revision, only 22 are represented by more than 10 specimens (*bicolor*, *chalybeus*, *cliffordi*, *confusus*, *crassicornis*, *doddi*, *froggatti*, *funebris*, *glaucus*, *houstoni*, *iridipennis*, *littoralis*, *mimus*, *pusillus*, *relucens*, *rufoniger*, *sericeus*, *splendidus*, *striatulus*, *vicarius*, *viridis*, and *wheeleri*), whereas 24 are based on a single specimen (*albitarsis*, *ambonensis*, *arrernte*, *asperithorax*, *barakula*, *centralis*, *collaris*, *halli*, *karrathensis*, *kurandae*, *mandibularis*, *mesopleuralis*, *minutus*, *minys*, *nasutus*, *nasicornis*, *nitidus*, *politus*, *riparius*, *rufus*, *scintillans*, *tibialis*, *viridescens*, and *xanthomelas*), and 44 are known from one sex only. Three species have not been collected after 1919 (*collaris*, *emarginatus*, *ornatus*) and may be extinct. Specimens of six other species have been collected half a century or more apart (*argyreus*: 1914, 1916, 1988; *flavofasciatus*: 1912, 1914, 1981, 1987; *frontalis*: 1900, 1987; *kohli*: 1901, 1972, 1978;

niger: 1913, 1914, 1964; *nigror*: 1911, 1966, 1971). During my three expeditions to Australia of two month each, I collected only 252 specimens of nine species. Thirty-five species were first collected after 1975, in part as a result of mass collecting techniques such as Malaise traps and yellow pan traps, and also due to exploring areas rarely visited before (*barakula*, *bicellularis*, *deserticola*, *evansi*, *flavipes*, *flavorufoniger*, *genalis*, *glaucus*, *glossatus*, *glyptus*, *houstoni*, *karrathensis*, *kurandae*, *maculatus*, *mesopleuralis*, *mimus*, *minys*, *multipictus*, *nasutus*, *nigripes*, *pectinatus*, *rhamphigaster*, *riparius*, *rufus*, *sanguineus*, *scintillans*, *setulosus*, *sparsus*, *tibialis*, *triangularis*, *trichocephalus*, *vicarius*, *viridescens*, *xanthogaster*, and *xanthomelas*).

Geographic Distribution.— No two species have identical distributions, but they still can be grouped into distribution patterns. I recognize the following patterns for *Sericophorus* (some of them may reflect sampling error and will be amended when additional collection data are reported):

Entire continent: *bicolor*, *chalybeus* (except the north), *cliffordi* (except the north), *froggatti*, *littoralis* (except the north), *pusillus* (except center and south), *relucens*, *tuberculatus*, *vicarius*, *viridis*. One of these species (*froggatti*) also occurs in Tasmania.

Northern Australia (from Queensland to Western Australia): *doddi*, *rufoniger*.

Central Australia (north coast to south coast): *ruficollis*.

Eastern Australia: *affinis*, *argyreus*, *aurifrons*, *barakula clypeatus* (also Victoria), *collaris* (only southern Queensland), *crassicornis*, *emarginatus* (only southern Queensland), *erythrosoma* (only eastern Queensland, also northern part of Northern Territory), *flavofasciatus* (only Queensland), *frontalis* (only Queensland), *funebris*, *kohlii* (only Queensland), *metallescens*, *niger* (only southern Queensland), *ornatus* (only southern Queensland), *rufus* (Queensland only), *splendidus*.

Southeastern Australia: *albitarsis*, *laevigatus*, *minutus*, *nasutus*, *nigrescens*, *sericeus*.

Northern Queensland: *confusus*, *dipteroides*, *evansi*, *flavipes*, *genalis*, *kurandae*, *multipictus*, *politus*, *trichocephalus*, *xanthomelas*.

Queensland and Western Australia: *maculatus*, *niveifrons*.

Central southern Australia: *axillaris*, *cornutus*, *deserticola*, *fissus*, *nigror*, *punctum*, *rufithorax* (also New South Wales).

Southern part of Northern Territory: *arrernte*, *centralis*, *viridescens*.

Northern part of Northern Territory: *cardaleae*, *flavorufoniger*, *glyptus*, *laticeps*, *mandibularis*, *nasicornis*, *riparius*, *sparsus*.

Northern Territory and northwestern Western Australia: *glossatus*

Northern Territory and southwestern Western Australia: *houstoni*, *sanguineus*.

Northern Territory and central Western Australia: *mimus*.

Central western part of Western Australia: *bicellularis*, *chrysophorus*, *glaucus*, *karrathensis*, *lissonotus*, *mesopleuralis*, *scintillans*.

Southwestern part of Western Australia: *aliceae*, *argentifacies*, *asperithorax*, *minys*, *nigripes*, *protrudens*, *sabulosus*, *setulosus*, *wheeleri*, and *xanthogaster*.

Southern part of Western Australia: *politus*.

Tasmania: *iridipennis*.

New Guinea: *halli*, *papuanus*, *rhamphigaster*, and *subalaris*; *ambonensis* from the adjacent Ambon Island.

New Caledonia: *pulawskii* and *rhinoceros*.

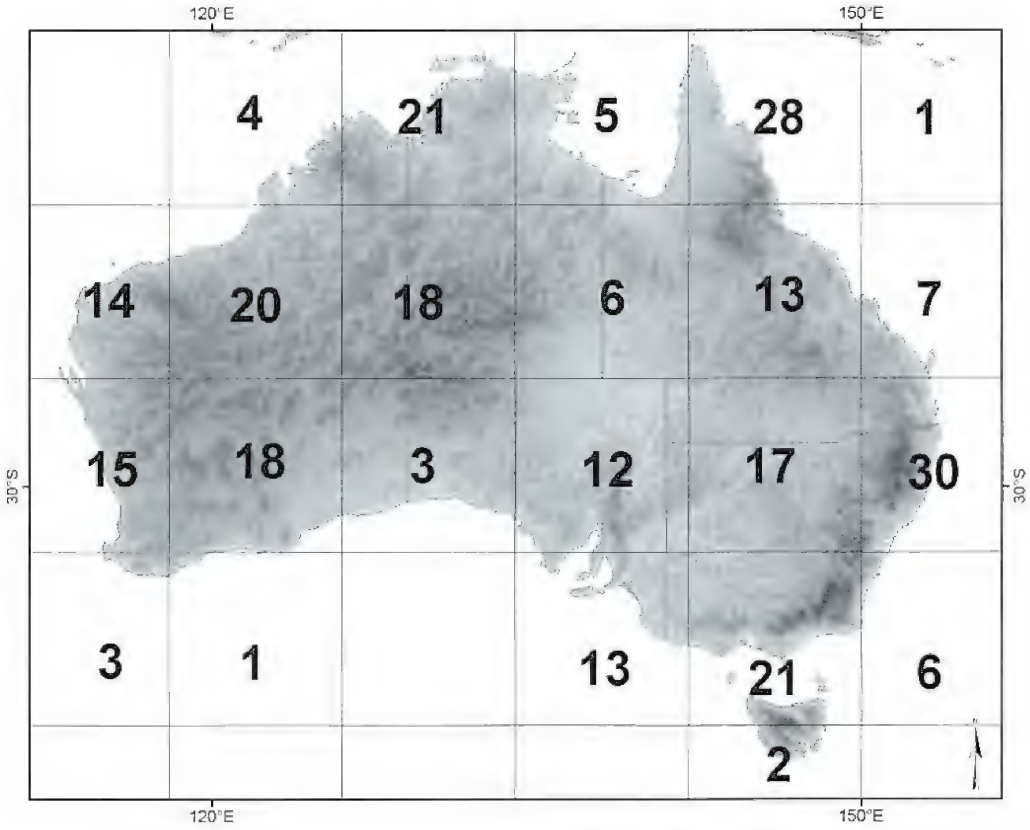

FIGURE 2. Number of species of *Sericophorus* in squares of 8 degrees of latitude and longitude.

PHYLOGENETIC ANALYSIS.— *Sericophorus* was placed in Miscophini by Bohart and Menke (1976) but assigned, together with *Larrisson*, to the tribe Sericophorini by Lomholdt (1985). Its relationships to the other genera of the tribe are largely unknown, although Lomholdt (1985:Fig. 3) thought that the genus was a sister taxon to *Larrisson*, and the two together were a sister taxon to *Lyroda* + other Larrini. I have used as an outgroup representatives of the four other miscophine genera with posteroventrally emarginate mandible that occur in Australia (*Aha*, *Larrisson*, *Lyroda*, and *Sphodrotes*) that appear to be more closely related to *Sericophorus* than the non-Australian genera. Since males are unknown for 39 species of *Sericophorus*, male characters have been excluded from the analysis. I assume, however, that all males of *Sericophorus* have 10 flagellomeres. Also not included are the two species described in the Appendix: *centralis* and *kurandae*.

The following is the list of characters:

1. Occipital carina: 0. joining hypostomal carina, 1. not joining hypostomal carina (not joining in *S. genalis* and *politus*).

2. Male flagellum: 0. with 11 flagellomeres, 1. with 10 flagellomeres.

3. Clypeus (surface): 0. without elevation, 1. with elevation.

4. Clypeus (emargination): 0. not or inconspicuously emarginate, 1. emarginate, 2. emarginate over more than half of its length.

5. Clypeal lamella of female: 0. without lateral tooth, 1. with one lateral tooth, 2. with two or three lateral teeth.

6. Clypeus (color): 0. all or largely black or reddish, 1. yellow at least in female.

7. **Distance between antennal socket and clypeal free margin**: 0. more than socket width, 1. equal to socket width or smaller (state 1 occurs *S. doddi*, *flavipes*, *genalis*, *laticeps*, *nitidus*, *pectinatus*, *politus*, and *sparsus*).
8. **Frons punctation**: 0. dense (punctures 1–3 diameters apart), 1. sparse (punctures several diameters apart).
9. **Scapal basin**: 0. absent (frons uniformly punctate), 1. glabrous or sparsely setose scapal basin, surrounded by dense setae, present above each antennal socket (present only in *Larrisson abnormis*, *S. genalis*, and *S. trichocephalus*, also in *S. minys*).
10. **Mandible (posterior margin)**: 0. straight or slightly concave between base and notch, 1. convex between base and notch (convex in *Aha evansi* and in *S. ambonensis*, *halli*, *laevigatus*, and *mandibularis*).
11. **Setae of upper frons and postocellar area**: 0. appressed or nearly so, 1. erect.
12. **Pronotal collar (height)**: 0. reaching level of scutum, 2. not reaching level of scutum.
13. **Pronotal collar (emargination)**: 0. not emarginate or minimally emarginate mesally, 1. conspicuously emarginate mesally (*emarginatus*, *lissonotus*, *niger*).
14. **Propleuron**: 0. not expanded, 1. expanded posterolaterally.
15. **Scutal flange**: 0. ending gradually, 1. ending abruptly.
16. **Scutellum**: 0. not swollen, 1. conspicuously swollen.
17. **Axilla**: 0. not expanded, 1. expanded, overhanging anterolateral portion of scutellum.
18. **Scutum (color)**: 0. scutum black or with metallic luster, 1. scutum reddish brown.
19. **Scutellum (color)**: 0. scutellum black or with metallic luster, 1. scutellum reddish brown or yellow.
20. **Propodeal posterior surface**: 0. without medioventral carina, 1. with medioventral carina (state 1 occurs in *Lyroda*, *Sph. punctuosa*, and in *Sericophorus*).
21. **Propodeal dorsum (setae)**: 0. setose throughout, 1. glabrous along median sulcus, 2. enclosure all glabrous
22. **Propodeal dorsum (median sulcus)**: 0. sulcus shallow, ill defined, 1. sulcus deep, well defined.
23. **Propodeal dorsum (sublateral carina)**: 0. carina absent, 1. carina present.
24. **Transverse carinae between propodeal side and posterior surface**: 0. carinae absent, 1. carinae present.
25. **Longitudinal carina between propodeal side and posterior surface**: 0. carina absent, 1. carina varying (present or absent), 2. carina present.
26. **Forewing media**: 0. diverging from M+Cu basad of cu-a, 1. varying, 2. diverging from M+Cu distad of cu-a, 3. interstitial.
27. **First recurrent vein**: 0. joining first submarginal cell (interstitial in some *Sphodrotes* and some *Sericophorus pusillus*), 1. joining second submarginal cell.
28. **Second submarginal cell**: 0. wide anteriorly, 1. narrow anteriorly or triangular, 2. petiolate (petiolate in *Sphodrotes* and some *Sericophorus subalaris*.
29. **Forecoxal venter**: 0. densely punctate, 1. sparsely punctate.
30. **Forecoxa (color)**: 0. black, reddish brown, or with metallic luster, 1. yellow.
31. **Hindtibia**: 0. at most as thick as hindfemur, 1. thicker than hindfemur.
32. **Claws**: 0. of equal size, 1. one claw in each pair larger than other (in *Aha*).
33. **Basolateral carina of tergum I**: 0. ending well before spiracle foremargin, 1. reaching the level of spiracle foremargin.
34. **Tergum I (spine-like, lateral projection)**: 0. projection absent, 1. projection present.
35. **Female tergum VI**: 0. punctures about one diameter apart, 1. punctures averaging several diameters apart.
36. **Sternum I (carinae)**: 0. with basomedian carina (simple or bifurcating), 1. with three carinae (*cardaleae*, *multipictus*).
37. **Sternum I (process)**: 0. process absent, 1. process present at least in female (*clypeatus, fissus*, *rhamphigaster*).
38. **Metallic luster (head)**: 0. without green or blue luster, 1. frons with green or blue luster
39. **Metallic luster** (thorax, propodeum, and gaster): 0. without such luster, 1. luster present.
40. **Gastral base of female**: 0. black or with metallic luster, 1. reddish brown.
41. **Gaster (presence of yellow spots)**: 0. without yellow spots, 1. with yellow spots.

The following data matrix was constructed using the *WinClada* version 1.00.08 (Nixon 2002). Multiple character states were treated as additive. Several species have identical coding and are treated as single terminal taxa:

affinis, bicellularis, confusus, and *glossatus*;
barakula and *rufus*;
bicolor and *scintillans*;
crassicornis and *pusillus*;
kohlii and *striatulus*
littoralis and *niveifrons*;
mesopleuralis, ruficollis, and *sanguineus*;
metallescens and *sabulosus*;
nigrescens and *protrudens*;
pulawskii+ *rhinoceros*;
striatulus and *subalaris*.

Lyroda subita	1000200000	1000000000	0001012000	0010000000	0
Aha evansi	1000200001	0001000000	0000001000	0100000000	0
Sphodrotes punctuosa	1000200000	0000000000	0000031200	0000100000	0
Larrisson abnormis	1000201000	0000000000	2000020100	0000100000	1
Larrisson nedymus	1000000010	0000000000	2000000100	0000000000	1
affinis + *bicellularis*+ *confusus* + *glossatus*	0100210000	0000100001	1000000101	0000000000	0
albitarsis	0100110000	0000100001	1000010100	0000000000	0
aliceae	0100200000	1000000001	1101210110	0000000110	0
ambonensis	0100200001	0000000001	1000000100	0000000000	0
argentifacies	0100100000	1000000001	1101010100	0000000010	0
argyreus	0100110000	0000100001	1000000100	0000000000	0
arrernte	0100010000	0100101001	1000010100	0010000000	0
asperithorax	0100200000	1000000001	1000000100	0000000000	0
aurifrons	0100200000	0000100001	1000000100	0000000001	0
axillaris	0100001000	0000101001	1000230100	0010100000	0
barakula + *rufus*	0100200000	1000000001	1101210100	0000000001	0
bicolor + *scintillans*	0100200000	1000000001	1101210100	0000000111	0
cardaleae	0111210000	0001100011	1000000100	0000010001	0
chalybeus	0100200000	1000010001	1101010100	0000000110	0
chrysophorus	0100200000	0000100001	1100000100	0000000000	0
cliffordi	0100200000	1000010001	1101110100	0000000110	0
clypeatus	0112210000	0001100001	1000010101	0000000000	0
collaris	0100210000	0000000011	1000000100	0000000001	0
cornutus	0110210000	0001100011	1000010101	0011001001	0
crassicornis+*pusillus*	0100200000	0000100001	1000000101	0000000000	0
deserticola	0100100000	0100100001	1000030101	1000100000	0
dipteroides	0100210000	0100000111	1101010100	0000000001	0
doddi	0100211000	0000100001	1001110101	0000000000	0
emarginatus	0100200000	0010000001	1000000100	0000000000	0
erythrosoma	0100210000	0000100001	1000000100	0000000111	0
evansi	0100200000	1000000001	1101010100	0000000000	0
fissus	0112210000	0001100001	1000000101	0010001001	0
flavipes	0100201000	0000100001	1000030100	0000000000	0
flavofasciatus	0110210000	0001100111	1000000100	0010001001	1
flavorufoniger	0100100000	0000100111	1000010101	0000000000	0
froggatti	0100200000	0000100001	1010000100	0000000000	0
frontalis	0100210000	0000100111	1000000101	0000000000	0
funebris	0111200000	1000100001	1010000100	0000000000	0
genalis	1100011010	0000100001	1100030101	0000000001	0
glaucus	0100200000	1000010001	1101010100	0000000110	0
glyptus	0100200000	0000100001	1000200100	0000000000	0
houstoni	0100200000	0000000001	1000210100	0000000001	0
iridipennis	0100200000	0100100001	1000010100	0000000000	0
karrathensis	0110000000	0001000011	1000030100	0000000000	0
kohlii + *striatulus*	0100200000	0000100001	1000000000	0000000000	0
laevigatus	0100200001	0001100001	1000000100	0000000000	0

laticeps	0100211000	0000100001	1000000100	0000000000	0
lissonotus	0100200000	0010100001	1000000100	0000000000	0
littoralis + niveifrons	0100200000	1000000001	1101010100	0000000010	0
maculatus	0100200000	0000000011	1000010100	0000000001	0
mesopleuralis + ruficollis + sanguineus	0100200000	1000000001	1101210100	0000000000	0
metallescens + sabulosus	0100200000	1000000001	1101210100	0000000110	0
minus	0100200000	0000100101	1000000100	0000000000	0
multipictus	0110210000	0001100011	1000000100	0000010001	0
nasicornis	0110210000	0001100001	1000000100	0000001001	0
nasutus	0119200000	0001100001	1000030101	0010001000	0
niger	0100210000	0010100001	1000000100	0000000000	0
nigrescens+protrudens	0100200000	1000010001	1101010100	0000000000	0
nigripes	0100200000	1000000001	1101010100	0000000110	0
nigror	0110210001	0001100001	1000010101	0000001000	0
nitidus	0100200100	0100000001	1100010110	0000100000	0
ornatus	0100210000	0000100001	1000000101	0000000001	0
papuanus	0100200000	0000000001	1000000100	0000000000	0
pectinatus	0100200100	0100101001	1111210110	0000100000	1
politus	1100211100	0100101001	1101230110	0000100000	1
pulawskii+rhinoceros	0111010000	0001000001	1000000000	0011001000	0
relucens	0100200000	0001000011	1100120100	0000000000	0
rhamphigaster	0110010000	0001000011	1000000101	0010001001	0
riparius	0100210000	0100100001	1000000000	0000000000	0
rufithorax	0100111000	0100000111	1000020101	0000100001	0
rufoniger	0100210000	0000100101	1000000101	0000000000	0
sericeus	0110210001	0001100011	1000000101	0011001001	0
setulosus	0100200000	1000010001	1101210100	0000000000	0
sparsus	0100200100	0100100001	1000210000	0000000000	0
splendidus	0110210000	0001100001	1000000100	0010000001	0
striatulus + subalaris	0100200000	0000100001	1000000100	0000000000	0
tibialis	0100101000	0000100001	1000010100	1000000000	0
triangularis	0100200000	1100000001	1101210100	0000000000	0
trichocephalus	0100200010	0000100001	1000000100	0000000000	0
tuberculatus	0110200000	0001100001	1000000100	0010001001	0
vicarius	0100210000	0100100001	1000020100	0000000000	0
viridescens	0100200000	1000000001	1101200110	0000000110	0
viridis	0100200000	1000000001	1101110100	0000000010	0
wheeleri	0100200000	0000000001	1101010100	0000000111	0
xanthogaster	0100200000	0100000011	1100210100	0000000000	1
xanthomelas	0100200000	0000100001	1000030101	0000000000	0

Parsimony analyses under equal and implied weights were performed with TNT (Goloboff et al. 2003). For the equal weights analyses five replicates of 1,500 random additions of taxa were performed, with sectorial searches, tree fusing, and tree drifting algorithms (Goloboff and Farris, 2001). The parameters for all algorithms were the program defaults, except tree drifting where three cycles were used instead of 10. Jackknife support values (Farris et al., 1996) were calculated with 2,000 replicates, with a probability of 36% of character removal and search parameters per replica of 200 random additions of taxa followed by TBR branch swapping algorithms. For the implied weights analyses (Goloboff 1993) 500 random additions of taxa followed by TBR algorithms were performed. The random seed for both analyses was one. Implied weight concavities from one to 100 were performed with a script, and the set of the most parsimonious trees (MPTs) was chosen as a working hypothesis. Symmetric resampling (Goloboff et al. 2003) support values were calculated with 2,000, with a change probability of 33% and search parameters per replica of

200 random taxa additions followed by TBR. A concavity in which all the cladograms were the MPTs was used to calculate these support values.

A total of 56 cladograms of 179 steps each were found under equal weights (CI= 29, RI= 65). The strict consensus (Fig. 3) of these cladograms collapsed 65 nodes. Only three nodes had jack-knife support values higher than 51%, the highest support being 62% and the lowest 52%. A total of 44,781 cladograms of many suboptimal lengths were found under implied weights, of which 640 were the most parsimonious. The strict consensus of these cladograms (Fig. 4) collapsed 40 nodes. Only four nodes had symmetric resampling support vales over 51%, with 64% the highest and 53% the lowest.

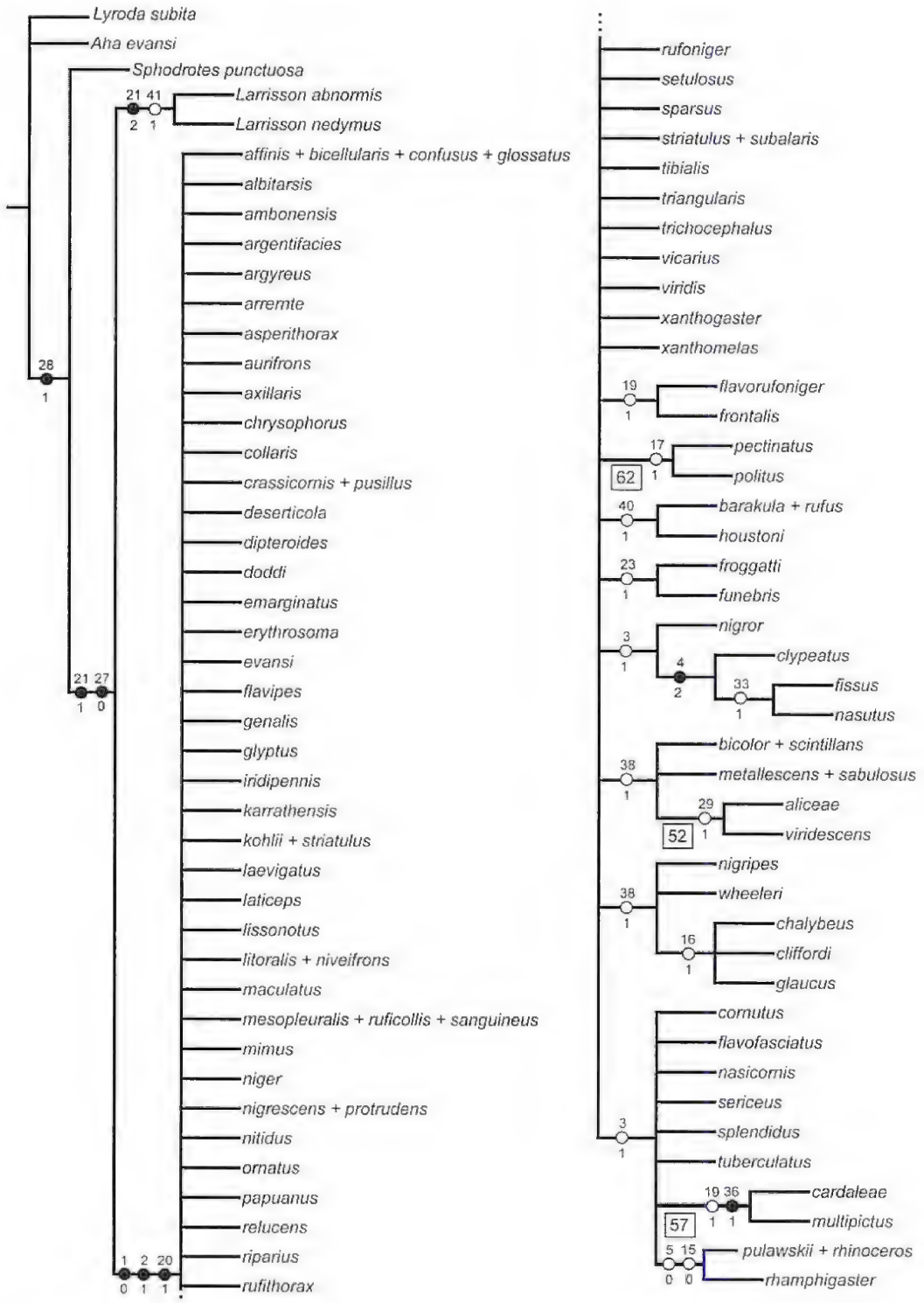

FIGURE 3. Strict consensus tree of the most parsimonious trees of *Sericophorus* generated under equal weights.

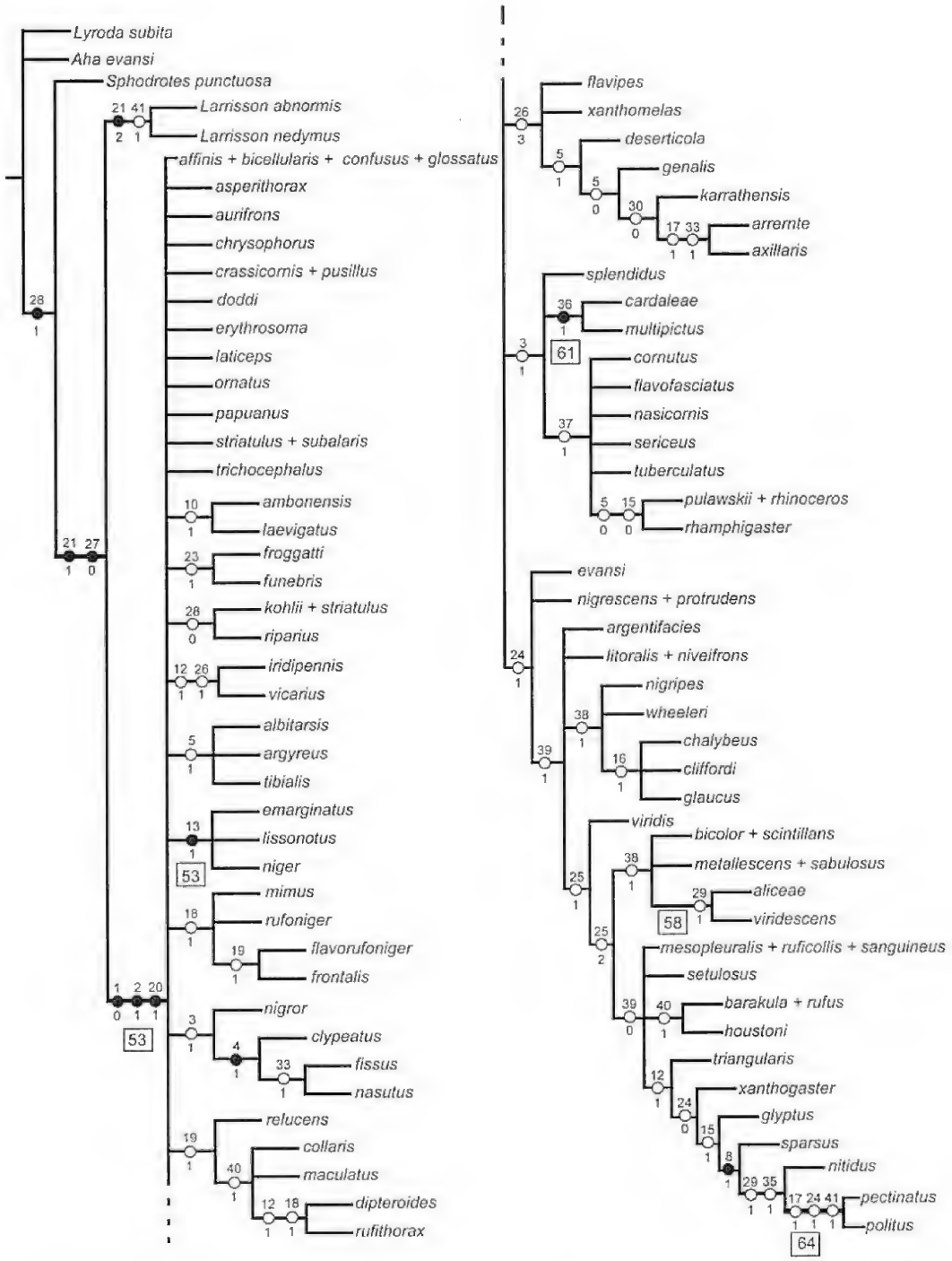

FIGURE 4. Strict consensus tree of the most parsimonious trees of *Sericophorus* generated under implied weights.

Key to Species

Warning: Details of sculpture should be examined under dispersed light (e.g., under fluorescent light), as they blur heavily under concentrated light such as fiber optics, particularly under higher magnifications.

1 Setae of upper frons and postocellar area erect, at least as long as 0.5 of midocellar width; thorax and propodeum all or largely black or with metallic luster; clypeus not elevated . . . 2
– Setae on at least postocellar area appressed or nearly erect but no longer than 0.3 × midocellar width, suberect in dipteroides (in which thorax and propodeum are all reddish brown), and in funebris (in which middle clypeal section is elevated) 34
2 Frons, vertex, and gena black 3
– At least postocellar area metallic green or blue, in most specimens also frons and gena (metallic luster faint in male of *nigripes*) 21
3 Gaster reddish brown 4
– Gaster black or metallic green or blue 5
4 Clypeal lamella narrower (Fig. 178), distance between inner teeth about equal to clypeal midlength . . . . . ***rufus* Pulawski, sp. nov.**, p. 185
– Clypeal lamella wider (Fig. 25), distance between inner teeth equal to 1.3 × clypeal midlength . . . . . ***barakula* Pulawski, sp. nov.**, p. 46
5 Gaster black 6
– Gaster with green or blue metallic luster 12
6 Mesopleuron ridged (punctate between ridges), scutum finely, transversely ridged . . . . . ***mesopleuralis* Pulawski, sp. nov.**, p. 125
– Mesopleuron and scutum punctate, without ridges 7
7 Ocellocular distance equal to 1.2–1.6 × hindocellar width 8
– Ocellocular distance equal to 0.7–0.9 × hindocellar width 10
8 Propodeum with series of minute oblique ridges between side and posterior surface (at least dorsally) except uppermost ridge is markedly larger; propodeal dorsum with longitudinal carina in shallow depression, without transverse carinae mesally . . . . . ***asperithorax* (Rayment)**, p. 41
– Propodeum with series of conspicuous transverse ridges between side and posterior surface, uppermost ridge not larger than remaining ones; propodeal dorsum with conspicuous longitudinal sulcus that contains longitudinal carina (but only basally) and several transverse carinae 9
9 Setae longer: up to 2.0 × midocellar width on lower mesopleuron and midfemoral venter (Fig. 188d, e), up to 1.5 × midocellar width on hindfemoral venter (Fig. 188f); anteroventral clypeal portion of female not concave . . . . . ***setulosus* Lomholdt, sp. nov.**, p. 194
– Setae shorter: up to 1.0 × midocellar width on lower mesopleuron, less than 1.0 × midocellar width on mid- and hindfemoral venters; anteroventral clypeal portion of female slightly concave . . . . . ***littoralis* Rayment**, p. 120
10 Propodeal side separated from posterior surface by series of oblique ridges that are not crossed by longitudinal ridge; horizontal part of tergum I with low, median swelling anteriorly . . . . . ***nigrescens* Lomholdt, sp. nov.**, p. 141
– Propodeal side separated from posterior surface by series of oblique ridges that are crossed by zigzagging, longitudinal ridge; horizontal part of tergum I without swelling anteriorly 11
11 Clypeal lamella slightly arcuate, lateral clypeal tooth nonprominent (Fig. 182); pronotal col-

lar attaining level of scutum; glabrous median sulcus of propodeal dorsum parallel-sided except basally; foretarsus and foretibia reddish brown ..... ***sanguineus* Lomholdt, sp. nov.**, p. 188

– Clypeal lamella markedly arcuate, lateral clypeal tooth prominent (Fig. 198a); pronotal collar not attaining level of scutum (Fig. 198b); glabrous median sulcus of propodeal dorsum broadening anterad (Fig. 198c); foretarsomeres I-IV dark brown, contrasting with reddish brown foretibia ..... ***triangularis* Lomholdt, sp. nov.**, p. 205

12 Females 13

– Males 17

13 At least pronotal collar reddish brown; scutum and mesopleuron black ..... ***ruficollis* Lomholdt, sp. nov.**, p. 179

– Pronotal collar black or metallic; scutum and mesopleuron in many specimens metallic green, at least slightly so 14

14 Middle clypeal section slightly concave in at least ventral third or so; outer tooth of clypeal lamella prominent (Fig. 108a). ..... ***littoralis* Rayment**, p. 120

– Middle clypeal section at least slightly, evenly convex or flat ventrally; outer tooth of clypeal lamella less prominent (Figs. 14a, 142a, 209a) 15

15 Scutum unsculptured and shiny between punctures; costal vein yellowish brown ..... ***niveifrons* Rayment**, p. 148

– Scutum markedly microsculptured and dull between punctures; costal vein dark brown or black 16

16 Setae of postocellar area and scutum about as long as 0.8 and 0.3 midocellar width, respectively; mesopleural punctures fine, ill defined, several diameters apart beneath scrobe; median sulcus of propodeal dorsum with dull lateral margin ..... ***argentifacies* Lomholdt, sp. nov.**, p. 36

– Setae of postocellar area and scutum about as long as 1.0–1.2 × and 0.7–1.0 midocellar width, respectively; mesopleural punctures well defined, averaging no more than two diameters beneath scrobe; median sulcus of propodeal dorsum with sharp lateral margin ..... ***viridis* (de Saussure)**, p. 216

17 Flagellomeres II-VI conspicuously prominent apicoventrally (Fig. 142c, 209c) 18

– Flagellomeres II-VI at most slightly convex ventrally (Fig. 14c) 19

18 Scutum shiny and unsculptured between punctures; setae of postocellar area and scutum about as long as 0.6 × and 0.3 × midocellar width, respectively ***niveifrons* Rayment**, p. 148

– Scutum markedly microsculptured and dull between punctures; setae of postocellar area and scutum about as long as 1.0–1.2 × and 0.7–1.0 midocellar width, respectively ..... ***viridis* (de Saussure)**, p. 216

19 Flagellomeres III-V evenly convex ventrally (Fig. 14c); metallic luster of gaster markedly contrasting with scutum (which is black or with faint metallic luster) ..... ***argentifacies* Lomholdt, sp. nov.**, p. 36

– Flagellomeres III-V cylindrical (ruficollis) or slightly convex apicoventrally (*littoralis*); color of gaster: see next couplet 20

20 Lateral angle of middle clypeal section sharp (Fig. 108b); metallic luster of gaster (if any) inconspicuous, no more intense than that of thorax and propodeum ..... ***littoralis* Rayment**, p. 120

– Lateral angle of middle clypeal section obtuse (Fig. 171b); metallic luster of gaster contrasting with black scutum and scutellum, at least slightly so ..... ***ruficollis* Lomholdt, sp. nov.**, p. 179

21 Gastral terga all or largely reddish brown 22
– Gastral terga all or largely metallic green or blue 23
22 Frontal punctures, near center, more than one diameter apart in female, about one diameter apart in male, not obscured by pilosity; ocellocular distance equal to 1.0 × hindocellar width; mesopleuron not obscured by pilosity; mid- and hindfemora black in many specimens (but reddish brown in some); terga all reddish brown..... ***bicolor* F. Smith,** p. 49
– Frontal punctures less than one diameter apart in both sexes, partly obscured by pilosity; ocellocular distance equal to 0.8 × hindocellar width; upper mesopleuron nearly completely concealed by pilosity; mid- and hindfemora almost all reddish brown; terga I-III with green or blue metallic spots..... ***scintillans* Pulawski, sp. nov.,** p. 189
23 Scutellum markedly convex, in basal half or two thirds with obtuse, median swelling whose apical end is prominent and contrasting in color with surrounding area (Fig. 34c) 24
– Scutellum not compressed into longitudinal swelling, uniformly metallic green or blue .. 26
24 Frons all metallic green; ocellocular distance equal to 1.3 × hindocellar width; horizontal area of tergum I with obtuse tubercle anteromesally (tubercle ill defined in small males). Male: at least forefemur reddish brown..... ***chalybeus* F. Smith,** p. 54
– Upper frons black; ocellocular distance either markedly larger of markedly smaller (see couplet 25); horizontal area of tergum I without tubercle. Male: femora metallic green or bluish green 25
25 Ocellocular distance equal to 1.8 × hindocellar width; setae about 2.0 × as long as midocellar width on interocellar area, about 1.0 × on hindfemoral venter. Female: tergum I of most specimens partly reddish brown. Male: clypeal lamella with two teeth on each side; antenna black ..... ***wheeleri* Lomholdt, sp. nov.,** p. 220
– Ocellocular distance equal to 0.8 × hindocellar width; setae about 1.2 × as long as midocellar width on interocellar area, about 0.5 × on hindfemoral venter. Female: tergum I metallic bluish green. Male: clypeal lamella without lateral teeth, flagellum brown ventrally..... ***glaucus* Pulawski, sp. nov.,** p. 102
26 Propodeal dorsum ridged on each side of median sulcus (punctate between ridges); femora metallic green, mid- and hindtibiae black..... 27
– Propodeal dorsum punctate on each side of median sulcus; if ridged (some cliffordi) then femora black and tibiae reddish brown; if finely rugose (minutus), then most of femora and all tibiae reddish brown..... 28
27 Episcrobal area longitudinally ridged; scutal punctures conspicuous; clypeal middle lobe narrower (Fig. 9a); rake spines of forebasitarsus longer than forebasitarsus apical width..... ***aliceae* Turner,** p. 33
– Episcrobal area not ridged; scutal punctures inconspicuous; clypeal middle lobe wider (Fig. 116a, b); rake spines of forebasitarsus no longer than forebasitarsus apical width..... ***metallescens* Rayment,** p. 127
28 Femora all or largely reddish brown to yellowish red 29
– Femora black or metallic green or bluish (forefemur partly reddish brown in *evansi*).... 30
29 Propodeal dorsum finely rugose on each side of median sulcus; wing veins pale yellow; apical depressions of terga impunctate, microsculptured ..... ***minutus* Rayment,** p. 131
– Propodeal dorsum punctate on each side of median sulcus; wing veins brown; apical depressions of terga punctate ..... ***protrudens* Lomholdt, sp. nov.,** p. 158
30 Ocellocular distance 1.7 × hindocellar width 31
– Ocellocular distance equal to 0.7–1.0 × hindocellar width 32

31 Clypeal lamella slightly arcuate, outer tooth nonprominent (Fig. 40a, b); tibiae reddish brown. ..... ***cliffordi* Rayment,** p. 61
– Clypeal lamella straight, outer tooth prominent (Fig. 135a, b); mid- and hindtibiae black... ..... ***nigripes* Lomholdt, sp. nov.,** p. 142
32 Flagellum black (apical half brown ventrally in female, at most flagellomeres VII-IX brown ventrally in male) ..... ***sabulosus* Lomholdt, sp. nov.,** p. 186
– Flagellum yellowish brown or reddish brown 33
33 Median sulcus of propodeal dorsum markedly narrower than length of metanotum; mesopleuron mesally unsculptured between punctures; outer lateral tooth of clypeal lamella nonprominent; greatest length of flagellomere V 0.8 × apical width. Female: apical rake spine of forebasitarsus 1.3–1.5 × as long as basitarsus apical width .... ***evansi* Lomholdt, sp. nov.,** p. 80
– Median sulcus of propodeal dorsum as wide as length of metanotum (Fig. 208c); mesopleuron microsculptured between punctures; outer lateral tooth of clypeal lamella prominent; greatest length of flagellomere V 0.6 × apical width. Female: apical rake spine of forebasitarsus about 1.8 × as long as basitarsus apical width... ***viridescens* Lomholdt, sp. nov.,** p. 214
34 Forewing with two submarginal cells; female frons yellow at least lateroventrally 35
– Forewing with three submarginal cells; female frons black or metallic green or blue, yellow ventrally in females of *albitarsis* and *genalis* 36
35 Second submarginal cell widely open anteriorly, length of radial margin about equal to maximum height (Fig. 78d); thorax and propodeum largely reddish brown; forewing uniformly transparent..... ***frontalis* Turner,** p. 95
– Second submarginal cell narrowly open anteriorly, length of radial margin markedly less than height (Fig. 27c); thorax and propodeum black; forewing apex with dark spot (spot faint in male) ..... ***bicellularis* Pulawski, sp. nov.,** p. 48
36 Sternum I with conspicuous, hook-like projection that overhangs base or sternum II (Figs. 165a, 166b); middle clypeal lobe raised above labrum; distance between hindocelli equal to hindocellar width; Papua New Guinea ..... ***rhamphigaster* Menke,** p. 173
– Sternum I without projection or projection not hook-like; middle clypeal lobe not raised above labrum; distance between hindocelli greater than hindocellar width..... 37
37 Scutellum yellow 38
– Scutellum reddish brown or black 39
38 Terga without yellow markings, at least terga I, II, and VI reddish brown (Fig. 110a); flagellum reddish brown dorsally, yellowish brown ventrally; pronotal collar pale yellow; axilla and metanotum black; ocellocular distance equal to 0.6 × hindocellar width; propodeal dorsum with fine ridges that become evanescent near posterior margin; propodeal side separated from posterior surface by minute, evanescent ridges ..... ***maculatus* Pulawski, sp. nov.,** p. 122
– Terga black, with yellow markings (Fig. 215a); flagellum black (except flagellomeres I and II yellow); pronotal collar black; axilla and metanotum yellow; ocellocular distance 1.5–1.6 × hindocellar width; propodeal dorsum coarsely rugose; propodeal side separated from posterior surface by coarse, conspicuous ridges..... ***xanthogaster* Lomholdt, sp. nov.,** p. 223
39 Frons with prominent tooth at about midheight (Figs. 82e, 202a, b)..... 40
– Frons evenly rounded 41
40 Lower gena without expansion; mandible evenly curved, simple apically; sternum I with median ridge that bifurcates near sternal midlength, area posterad of bifurcation concave, punctate. Female: frons black. Male: flagellomere III with tooth-like, apical swelling ventrally (Fig. 203a) ..... ***tuberculatus* (Turner),** p. 209

– Lower gena with irregular expansion (Fig. 83); mandible straight, bidentate apically (Fig. 82a, c, d), dorsal tooth shorter; sternum I with median ridge simple, area posterad of ridge flat. Female lower frons yellow (Fig. 82a). Male: flagellomere III cylindrical. . . . . ***genalis* Pulawski, sp. nov.**, p. 99

41 Basolateral carina of tergum I ending behind anterior margin of spiracle (Fig. 128e); scutum black except reddish brown in many flavofasciatus (in which frontal integument is clearly visible mesally). 42

– Basolateral carina of tergum I ending before anterior margin of spiracle except ending behind anterior margin in some rufithorax (in which scutum is reddish brown and pilosity completely conceals frons up to hindocellus) 50

42 Tergum I on each side with conspicuous conical projection that is best seen in dorsal view (Fig. 168d, f, 186c) 43

– Tergum I at most with rudimentary projection 47

43 Free margin of clypeal lobe emarginate (Fig. 155a, 168a, c); basal elevation of sternum I conspicuously bulging (Fig. 155c, 168e); thorax, propodeum, and gaster all black. New Caledonia 44

– Free margin of clypeal lobe not emarginate; basal elevation of sternum I not bulging; scutellum or gaster reddish brown. Australia 45

44 Middle clypeal section with projection that is raised dorsad and is conspicuously longer than scape in profile (Fig. 168b) . . . . . ***rhinoceros* Pulawski,** p. 175

– Middle clypeal section with round tubercle that is shorter than scape in profile (Fig. 155b) . . . . . ***pulawskii* Ohl,** p. 160

45 Clypeal elevation culminating into low projection (Fig. Fig. 185e); metanotum reddish brown; posterior mandibular margin convex between base and notch . . . . . ***sericeus* (Kohl),** p. 191

– Clypeal elevation culminating into conspicuous projection (Fig. 49c, 128b); metanotum pale yellow or black; posterior mandibular margin straight between base and notch 46

46 Scutellum and metanotum black, gaster reddish brown; free margin of clypeal lamella emarginate (Fig. 128a); tergum I: apical depression asetose, basolateral carina expanded (Fig.128e). . . . . ***nasicornis* Lomholdt, sp. nov.**, p. 136

– Scutellum reddish brown, metanotum pale yellow, gaster largely black (Fig. 49a); free margin of clypeal lamella straight (Fig. 49b); tergum I: apical depression almost totally concealed by setae, basolateral carina not expanded . . . . . ***cornutus* Lomholdt, sp. nov.**, p. 67

47 Basolateral carina of tergum I conspicuously high; sternum I with transverse lamella slightly behind midlength (lamella curved posterad on each side), with membranous, concave area between lamella and posterior margin; at least terga I and IV with pale yellow fascia. . . . . ***flavofasciatus* (Turner),** p. 86

– Basolateral carina of tergum I low, inconspicuous; sternum I different; terga without yellow 48

48 Middle clypeal section without elevation. Papua New Guinea . . . . . ***papuanus* Pulawski, sp. nov.**, p. 152

– Middle clypeal section with elevation. Australia 49

49 Clypeal elevation vertical (Fig. 129c); ocellocular distance equal to 1.4 × hindocellar width; propodeal dorsum with short, oblique carinae emerging from median carina; apical depression of tergum II impunctate; sternum I with spiny process (as in Fig. 138, *nigror*); setae of frons and clypeus golden; gaster black. Female: posterior margin of mandible simple . . . . . ***nasutus* Pulawski, sp. nov.**, p. 138

– Clypeal elevation transverse (Fig. 191a-d); ocellocular distance equal to 0.8–0.9 × hindocellar width; propodeal dorsum without oblique carinae, median carina simple; apical depression of tergum II finely punctate (except apicomesally); sternum I without spiny process; setae of frons and clypeus silvery; gaster reddish brown in many specimens. Female: posterior margin of mandible shallowly emarginate next to notch in most specimens. . . . . ***splendidus* (Hacker and Cockerell),** p. 197

50 Scutum reddish brown 51

– Scutum black or with metallic luster 56

51 Thorax, propodeum, and legs all reddish brown 52

– Mesothoracic venter black, legs with yellow markings except in mimus 53

52 Gastral segments II-VI black or brownish; frons setose throughout; setae of interocellar area suberect; pronotal collar not attaining level of scutum; scutal flange not expanded. . . . . ***dipteroides* Turner,** p. 73

– Gaster all reddish brown; frons with asetose area above antennal base (Fig. 219b); setae of interocellar area appressed; pronotal collar attaining level of scutum; scutal flange expanded (Fig. 219d) . . . . . ***kurandae* Pulawski, sp. nov.,** p. 231

53 Pronotum all reddish brown, largely blackish in some males of mimus, scutellum and metanotum black. Female: clypeal lamella with two lateral teeth on each side except in some mimus; flagellum black at least basally 54

– Pronotal collar pale yellow, scutellum and metanotum reddish brown. Female: clypeal lamella with one lateral tooth; flagellum all or largely pale yellow to yellowish red 55

54 Clypeus yellow, mesopleuron reddish brown (all or largely so); forecoxa pale yellow or reddish brown, fore- and midfemora with pale yellow apex, hindtibia at least partly pale yellow dorsally. Male: greatest length of flagellomere IX about 1.0 × basal width . . . . . ***rufoniger* Turner,** p. 183

– Clypeus and mesopleuron black; forecoxa black, femora, tibiae, and tarsi reddish brown. Male: greatest length of flagellomere IX about 0.6 × apical width . . . . . ***mimus* Pulawski, sp. nov.,** p. 128

55 Clypeus, hindfemur, and midtibia yellow; propodeum black; gaster reddish brown (Fig. 173a), only tergum I red in male; setae completely concealing integument on frons up to hindocellus . . . . . ***rufithorax* Lomholdt, sp. nov.,** p. 181

– Clypeus, hindfemur, midtibia (all or largely) black, propodeum reddish brown, gaster black (Fig. 73a); frontal setae not concealing integument . . . . . ***flavorufoniger* Pulawski, sp. nov.,** p. 89

56 Scutellum reddish brown 57

– Scutellum black. 62

57 Clypeal middle section elevated, elevation all or largely glabrous and concave ventrally; clypeal lamella straight or emarginate. Male: flagellomere III with angular tubercle ventrally (unknown in *karrathensis*) 58

– Clypeal middle section not elevated; clypeal lamella slightly arcuate. Male: flagellomere III without ventral tubercle 61

58 Metanotum reddish brown; legs without yellow spots. . . . . ***karrathensis* Pulawski, sp. nov.,** p. 113

– Metanotum pale yellow; at least forefemur and foretibia with yellow spots. 59

59 Clypeal lamella straight; posterior mandibular margin markedly convex between base and notch; sternum I not carinate . . . . . ***mandibularis* Lomholdt, sp. nov.,** p. 124

– Clypeal lamella emarginate; posterior mandibular margin straight between base and notch; sternum I with three carinae 60

60 Sternum I without preapical sulcus; clypeal emargination deeper (Fig. 32a, b) . . . . . ***cardaleae* Lomholdt, sp. nov.,** p. 52

– Sternum I with arcuate preapical sulcus; clypeal emargination shallower (Fig. 125a, b) . . . . . ***multipictus* Pulawski, sp. nov.,** p. 133

61 Propodeal enclosure with posterolateral sulcus and deep, well defined median sulcus (Fig. 162d); propodeal side delimited from posterior surface by longitudinal carina; clypeus black; pronotum tricolored: black anteriorly, reddish mesally, yellow posterolaterally (Fig. 162c); preapical portion of tergum I with punctures markedly sparser than those of tergum II (Fig. 162e) . . . . . ***relucens* F. Smith,** p. 165

– Propodeal dorsum without posterolateral sulcus, with median carina, slightly concave on each side of carina; propodeal side not delimited from posterior surface by carina; clypeus yellow (Fig. 45b); pronotum essentially bicolored, with insignificant amount of reddish brown between black and yellow areas; punctures of tergum I as dense as those of tergum II . . . . . ***collaris* (Hacker and Cockerell),** p. 64

62 Pronotal collar conspicuously emarginate mesally (Figs 59e, 107c) 63

– Pronotal collar not emarginate or inconspicuously emarginate 65

63 Scutal punctures near center averaging between one and two diameters apart; mesopleural punctures averaging several diameters apart near center; clypeus all yellow . . . . . ***lissonotus* Lomholdt, sp. nov.,** p. 119

– Scutal punctures less than one diameter apart; mesopleural punctures about one diameter apart near center; clypeus partly or all black 64

64 Part of femora and tibiae reddish brown. Female: clypeal lamella slightly more arcuate (Fig. 59a), narrowly reddish along free margin, apical depressions of terga I and II and tergum VI reddish brown. Male: pronotal lobe black . . . . . ***emarginatus* (Hacker and Cockerell),** p. 76

– Femora and tibiae black. Female: clypeal lamella slightly less arcuate (Fig. 130a), clypeal section and gaster all black. Male: pronotal lobe pale yellow . . . . . ***niger* (Hacker and Cockerell),** p. 139

65 Pronotum all or largely reddish (pronotal lobe pale yellow) . . . . . ***pusillus* (Hacker and Cockerell),** p. 163

– Pronotum black or with yellow markings. 66

66 Clypeus emarginate mesally over more than half of its length (Figs 42a, b, 66a, c); sternum I with conspicuous tooth-like or spine-like projection (Fig. 66e). 67

– Clypeus not emarginate of slightly emarginate; sternum I without projection (except low projection present in *nigror*). 68

67 Clypeal emargination narrow, almost parallel-sided (Fig. 66a, c); frons evenly convex; frontal setae golden; gaster light reddish brown; basolateral carina of tergum I apically ending in front of spiracle as transverse expansion (Fig.66d); process of sternum I narrow, spine-like (Fig. 66e). . . . . ***fissus* Lomholdt, sp. nov.,** female, p. 82

– Clypeal emargination broad, its margins markedly diverging ventrad (Fig. 42a, b); frons concave above each antennal socket, with median swelling above concavities; frontal setae silvery; gaster black; basolateral carina of tergum I simple (not expanded apically); process of sternum I wide, tooth-like . . . . . ***clypeatus* (Rayment),** female, p. 62

68 At least terga III-V reddish brown 69

– Gaster black (apical terga reddish brown in some species) or (female of houstoni) only terga I and II reddish brown. 71

69 Frons, scutum, and propodeal dorsum with metallic luster . . . . ***erythrosoma*** **(Turner),** p. 78

– Frons, thorax, and propodeum without metallic luster. 70

70 Clypeus all yellow in female, partly so in male; forecoxa partly yellow; setae totally obscuring integument on lower frons laterally. Male: setae of sterna II-VI inconspicuous, appressed or nearly so (except setae at base of apical depressions long, erect) . . . . . ***ornatus*** **(Hacker and Cockerell),** p. 150

– Clypeus and forecoxa black; frontal setae not obscuring integument. Male: setae of sterna II-VI conspicuous, erect (Fig. 20c), in addition to setae at base of apical depressions . . . . . ***aurifrons*** **Lomholdt, sp. nov.,** p. 42

71 Propodeal dorsum with sublateral carina (Fig. 75e). 72

– Propodeal dorsum without sublateral carina. 75

72 Middle clypeal section with elevation whose ventral area is concave, glabrous (Fig. 80a-f); interocellar area with erect setae. . . . . ***funebris*** **Turner,** p. 97

– Middle clypeal section without elevation, uniformly setose (except glabrous along free margin); interocellar area with appressed setae 73

73 Frons with large unsculptured, glabrous area above each antennal socket; propodeal dorsum rugose (Fig. 123a, b); dorsomedian area of posterior propodeal surface unsculptured. Male: free margin of middle clypeal section with two lateral teeth; apical rake spine of forebasitarsus equal to 1.3 × apical basitarsus width . . . . . ***minys*** **Pulawski, sp. nov.,** p. 132

– Frons all punctate and setose; propodeal dorsum finely ridged and minutely punctate (Fig. 75e), ridges effacing toward apex; dorsomedian area of posterior propodeal surface rugose. Male: free margin of middle clypeal section with one lateral tooth; apical rake spine of forebasitarsus slightly shorter than apical basitarsus width 74

74 Posterior mandibular margin straight between base and notch. Australia . . . . . ***froggatti*** **Rayment,** p. 90

– Posterior mandibular margin convex between base and notch (Fig. 93b). Papua New Guinea . . . . . ***halli*** **Lomholdt, sp. nov.,** p. 107

75 Middle clypeal section with elevation whose ventral area is concave, glabrous (Fig. 137a, c), elevation inconspicuous in male (Fig. 137b, d); with longitudinal carina between top of elevation and frontoclypeal suture; frons with conspicuous median protuberance (Fig. 137e). Female: basal ridge of sternum I expanded into low, spiny process (Fig. 138) . . . . . ***nigror*** **Rayment,** p. 144

– Middle clypeal section without elevation and longitudinal carina; frons without protuberance. Female: basal ridge of sternum I not expanded into process 76

76 Hindtibia markedly swollen, thicker than hindfemur (Figs 53e, 197e) 77

– Hindtibia usual shape, not swollen, not thicker than hindfemur 78

77 Clypeal lamella not emarginate laterally, median section not prominent, distance between lateral corners minimally greater than interantennal distance (Fig. 53c); longest spine of forebasitarsus equal to 1.8 × basitarsus width; many punctures at center of pygidial plate about two diameters apart or more (Fig. 53d) . . . . . ***deserticola*** **Pulawski, sp. nov.,** p. 71

– Clypeal lamella emarginate laterally, median section (between *emarginations*) prominent, markedly narrower than interantennal distance (Fig. 197); longest spine of the forebasitarsus no longer than basitarsus width; punctures of pygidial plate at center less than one diameter apart. . . . . ***tibialis*** **Pulawski, sp. nov.,** p. 203

78 Head conspicuously wide (Fig. 106a): width about 1.5 × height (measured from clypeal free margin to vertex top); antennal socket separated from clypeal free margin by less than socket width (Fig. 106b); free margin of middle clypeal section double edged ..... ***laticeps* Lomholdt, sp. nov.**, p. 118

– Head not unusually wide: width about 1.1–1.28 × height (measured from clypeal free margin to vertex top); antennal socket separated from clypeal free margin by more than socket width; free margin of clypeal section simple 79

79 Clypeal lamella emarginate mesally (Fig. 66b); basolateral carina of tergum I apically ending in front of spiracle as transverse expansion (Fig. 66d); median carina of sternum I unusually high (Fig. 66f) ..... ***fissus* Lomholdt sp. nov., male**, p. 82

– Clypeal lamella not emarginate; basolateral carina of tergum I simple; median carina of sternum I low 80

80 Horizontal portion of axilla expanded, its outer margin markedly convex, overhanging depressed lateral portion (Figs 18b, 23c, 150b); female tergum VI sparsely punctate basally and mesally (Figs 23d, 152d), punctures at least two diameters apart 81

– Horizontal portion of axilla simple or swollen but not expanded, its outer margin straight or nearly so, not overhanging or slightly overhanging depressed lateral portion; female tergum VI densely punctate throughout (punctures about one diameter apart) except in nitidus .. 84

81 Scutal disk sparsely punctate, punctures 3–4 diameters apart (Fig. 152c); occipital carina not joining hypostomal carina ..... ***politus* Lomholdt, sp. nov.**, p. 156

– Scutal disk densely punctate (punctures about one diameter apart or less); occipital carina joining hypostomal carina 82

82 Propodeal dorsum conspicuously, finely areolate (Fig. 150c); orbital fovea lacking; mesopleural punctures concealed by vestiture in female, several diameters apart at center in male, those of mesothoracic venter many diameters apart in female; apical rake spine of foretarsomere II longer than tarsomere III (Fig. 150e); flagellum black (yellow to brown ventrally in female); terga IV and V in many specimens with narrow preapical whitish band; male tergum VII with a few, sparse punctures ..... ***pectinatus* Lomholdt, sp. nov.**, p. 153

– Propodeal dorsum punctate or ridged; orbital fovea well defined in female; mesopleural punctures and those of mesothoracic venter about one diameter apart; apical rake spine of foretarsomere II shorter than foretarsomere III; flagellum reddish brown; terga black; male tergum VII densely punctate (unknown in *arrernte*) 83

83 Propodeal dorsum punctate; punctures of terga I and II less than one diameter apart; setae of horizontal portion of tergum I fully concealing integument in anterior half; scutum with coppery shine ..... ***arrernte* Pulawski, sp. nov.**, p. 39

– Propodeal dorsum ridged; punctures of terga I and II several diameters apart; setae of tergum I not concealing integument; scutum black ..... ***axillaris* Lomholdt, sp. nov.**, p. 44

84 Frons sparsely punctate mesally, punctures several to many diameters apart (Figs 141a, 189a) 85

– Frons densely punctate, punctures about 1–2 diameters apart 86

85 Frons between punctures unsculptured, shiny; ocellocular distance equal to 1.2 × hindocellar width; scutal punctures 3–4 diameters apart; setae beneath scrobal sulcus conspicuous, contrasting with inconspicuous setae of episcrobal area; punctures of mesothoracic venter many diameters apart; punctures of pygidial plate up to several diameters apart (Fig. 141d); foretarsal rake long (outer, apical spine of foretarsomere III longer than foretarsomere IV); antenna (except apical flagellomere apically) and femora black ***nitidus* Pulawski, sp. nov.**, p. 147

– Frons between punctures microsculptured, dull; ocellocular distance equal to 0.6 × hindocellar width; scutal punctures averaging about one diameter apart; mesopleural setae inconspicuous, uniform beneath scrobal sulcus and on episcrobal area; punctures of mesothoracic venter about one diameter apart; punctures of pygidial plate no more than one diameter apart; foretarsal rake short (outer, apical spine of foretarsomere III about as long as foretarsomere IV); antenna and fore- and midfemora pale yellow, hindfemur reddish brown ..... ***sparsus* Pulawski, sp. nov.**, p. 196

86 Forecoxa yellow or yellowish red; pronotal collar reaching level of scutum or nearly so. 87

– Forecoxa all or largely black or dark brown, yellowish in some *vicarius* in which pronotal collar does not reach level of scutum (Fig. 205c) 93

87 Clypeus with triangular glabrous area adjacent to lamella that is about as long as distance separating it from frontoclypeal suture (Fig. 42c); flagellum black; propleuron with posterolateral prominence; hindcoxa largely black; apical depressions of terga I and II minutely punctate ..... ***clypeatus* (Rayment)**, male, p. 62

– Clypeus without glabrous area next to lamella or with narrow glabrous area that is markedly shorter than distance separating it from frontoclypeal suture; flagellum brown to pale yellow; hindcoxa reddish brown to pale yellow; apical depressions of terga I and II impunctate except in *xanthomelas* 88

88 Clypeus punctate and setose except lamella. Female: clypeus all or largely black. Male: sterna II-VI with conspicuous, erect setae (unknown in *xanthomelas*) 89

– Clypeus with narrow impunctate, asetose area adjacent to lamella (Fig. 5a-c, 56a, b). Female: clypeus yellow. Male: sterna with appressed setae (only the few setae at base of apical depressions erect) 91

89 Flagellum dorsally (Fig. 216) and pronotal collar pale yellow; forewing vein M interstitial with cu-a; femora black, fore- and midfemora pale yellow apically; apical depressions of terga I and II minutely punctate (impunctate along hindmargin) ..... ***xanthomelas* Pulawski, sp. nov.**, p. 225

– Flagellum bright yellowish brown dorsally; pronotal collar black; forewing vein M diverging from M-Cu basad of cu-a; femora yellow to reddish brown; apical depressions of terga I and II impunctate 90

90 Setae fully concealing integument on lower frons and clypeus ..... ***crassicornis* (Cockerell)**, p. 68

– Integument well visible on frons and clypeus ..... ***kohlii* (Turner)**, p. 115

91 Propodeal dorsum coarsely rugose posterolaterally; posterior surface with longitudinal, sublateral carina that may be sharp or ill defined ..... ***doddi* (Turner)**, p. 75

– Propodeal dorsum finely, minutely sculptured posterolaterally; posterior surface without longitudinal, sublateral carina 92

92 Clypeus densely punctate and setose mesodorsally (Fig. 5a-c). Male: two preapical flagellomeres combined shorter than apical one ..... ***affinis* (Hacker and Cockerell)**, p. 30

– Clypeus impunctate and asetose mesodorsally (Fig. 46a, b). Male: two preapical flagellomeres combined as long as apical one ..... ***confusus* Lomholdt, sp. nov.**, p. 65

93 Propodeal dorsum all conspicuously rugose (Fig. 95c); forebasitarsus rake spines longer, length of apical spine about 2.2 × apical width of basitarsus in female, about 1.5 in male. Female: terga I and II all or largely reddish brown .... ***houstoni* Lomholdt, sp. nov.**, p. 109

– Propodeal dorsum finely punctate or ridged except rugose posterolaterally in *flavipes* and *glyptus* and conspicuously ridged in median third in centralis; forebasitarsus rake spines shorter, apical spine no longer or insignificantly longer than basitarsus apical width except about 1.5 × apical width of basitarsus in *centralis*. Gaster all black 94

94 Apical depressions of tergum II minutely punctate, all or nearly so 95

– Apical depression of tergum II impunctate at least in apical half mesally 98

95 Propodeal dorsum asetose in median third; basolateral carina of tergum I roundly expanded (Fig. 00); episternal sulcus non-foveolate; occipital carina not joining hypostomal carina; apical depressions of terga yellowish . . . . . ***centralis* Pulawski, sp. nov.**, p. 229

– Propodeal dorsum asetose only along median sulcus; episternal sulcus foveolate; occipital carina joining hypostomal carina; apical depressions of terga not yellowish 96

96 Propodeal dorsum conspicuously ridged or rugose posterolaterally (adjacent to propodeal side and posterior face); dorsum and posterior surface separate from side by irregular carina; clypeal lamella with two lateral teeth on each side . . . . . ***glyptus* Pulawski, sp. nov.**, p. 105

– Propodeal dorsum finely sculptured posterolaterally; dorsum and posterior surface not separated from side by carina; clypeal lamella with one lateral tooth on each side 97

97 Clypeus with dark, median spot; frons with small pale yellow spot ventrolaterally; length 5.8 mm . . . . . ***albitarsis* Lomholdt, sp. nov.**, p. 32

– Clypeus all yellow; frons all black; length about 4.5 mm . . . . . ***argyreus* Hacker and Cockerell**, p. 38

98 Propodeal dorsum punctate on each side of median sulcus (ridged next to foremargin only) 99

– Propodeal dorsum finely ridged (interspaces between ridges finely punctate) 106

99 Glossa about three times as long as scape (Fig. 90c-e); femora largely black, mid- and hindtibiae pale yellow . . . . . ***glossatus* Lomholdt, sp. nov.**, p. 103

– Glossa shorter than scape, hidden in many specimens; leg color varying, but not as above. 100

100 Legs reddish brown or yellow 101

– Femora black, at least hindtibia dark brown or black ventrally 103

101 Antennal socket separated from clypeal free margin by socket width (Fig. 68a, b); posterolateral area of propodeal dorsum coarsely rugose (Fig. 68c); posterior propodeal surface ridged (except mesally); legs pale yellow; body length 4.4–4.6 mm in female, 3.6 mm in male. Male: clypeus yellow, clypeal lamella rounded laterally (Fig. 68b) . . . . . ***flavipes* Pulawski, sp. nov.**, p. 84

– Antennal socket separated from clypeal free margin by about two socket widths; posterolateral area of propodeal dorsum finely sculptured; posterior propodeal surface punctate (except mesally); legs reddish brown; body length 6.2–11.8 mm in female, 4.6–8.2 mm in male. Male: clypeus black, clypeal lamella dentate or angulate laterally (Figs. 37c and 103b) 102

102 Posterior mandibular margin slightly convex between articulation and notch; pronotal collar black; flagellum brown, reddish brown ventrally; propleuron expanded posterolaterally. . . . . ***laevigatus* (Rayment)**, p. 116

– Posterior mandibular margin straight between articulation and notch; pronotal collar with pair of pale yellow spots; flagellum black; propleuron not expanded. . . . . ***chrysophorus* Pulawski, sp. nov.**, p. 57

103 Subalar area angularly expanded (Fig. 196b); horizontal area of tergum I impunctate and asetose or with a few minute, isolated punctures and associated setae. Papua New Guinea and Ambon Island 104

– Subalar area not expanded; horizontal area of tergum I with many minute punctures and associated setae. Australia 105

104 Posterior mandibular margin straight; scutal punctured averaging about one diameter apart. Papua New Guinea ..... ***subalaris* Lomholdt, sp. nov.**, p. 202

– Posterior mandibular margin convex next to notch (Fig. 12b); scutal punctures about two diameters apart. Ambon Island ..... ***ambonensis* Pulawski, sp. nov.**, p. 35

105 Inner eye orbits minimally converging dorsad (Fig. 169a); clypeus yellow. Female: frons evenly setose, setae of ventral half not contrasting with those on dorsal half. Male: unknown. ..... ***riparius* Pulawski sp. nov.**, p. 177

– Inner eye margins slightly diverging dorsad (Fig. 199a); clypeus black. Female: ventral frons densely setose (setae obscuring integument), contrasting with dorsal frons where setae do not conceal sculpture (Fig. 199a). Male: tergum VI with tuft of erect setae in posterolateral corner (setal length no less than midocellar width). . . ***trichocephalus* Pulawski sp. nov.**, p. 207

106 Pronotal collar reaching level of scutum; propodeal dorsum with longitudinal ridges; body length 7.5–10.0 mm (female) and 7.5 mm (male). Male: length of apical flagellomere about 2.0 basal width (Fig. 193c) ..... ***striatulus* (Rayment)**, p. 200

– Pronotal collar not reaching level of scutum (Fig. 97f, 205c); propodeal dorsum with more or less oblique ridges; body length 4.0–5.8 mm (female) and 4.0–4.3 mm (male). Male: length of apical flagellomere 1.3–1.6 basal width 107

107 Male: head width about 1.3 × length, measured from clypeal free margin to vertex top (Fig. 157a); lateral corner of clypeal lamella prominent (Fig. 157b); flagellum dark brown dorsally, light brown ventrally ..... ***punctum* Lomholdt, sp. nov.**, p. 162

– Male: head width less than 1.2 × length; lateral corner of clypeal lamella not prominent (Figs. 97d, 205b0); flagellum either black or yellowish brown to reddish brown 108

108 Antenna black. Female: clypeal lamella straight (Fig. 97c0). Tasmania ..... ***iridipennis* (Hacker and Cockerell)**, p. 111

– Antenna yellowish brown to reddish brown (apical flagellomeres darkened dorsally). Female: clypeal lamella arcuate (Fig. 205a). Australia except Tasmania ..... ***vicarius* Lomholdt, sp. nov.**, p. 212

Descriptions of Species

Species are arranged alphabetically. Repetitive characters have been omitted; unless indicated otherwise, the following states apply:

– inner orbits converging dorsad, at least slightly so;
– antennal socket separated from clypeal free margin by two socket widths or more;
– occipital carina joining hypostomal carina (not joining in *centralis, genalis* and *politus*);
– interocellar area not convex adjacent to hindocellus, not concave mesally;
– middle clypeal section not elevated;
– clypeal lamella with two lateral teeth on each side, lateral tooth nonprominent;
– distance between antennal socket and clypeal free margin equal to two socket widths or more;
– frons, scutum, and mesopleuron microareolate and dull between punctures;
– pronotal collar not linear, not emarginate mesally or only inconspicuously emarginate;
– propleuron not prominent posterolaterally;
– episternal sulcus foveolate;
– scutellum not compressed into obtuse, median carina;
– propodeum without ridges (either longitudinal or transverse) between side and posterior surface;
– propodeal dorsum without sublateral carina;
– propodeal side not separated from posterior surface by transverse ridges intersected by zigzagging longitudinal carina
– first recurrent vein received by first submarginal cell (interstitial with first intersubmarginal vein in some *glossatus*)
– forecoxal venter dull, densely punctate;
– tergum I with anterior declivity not concave, without swelling or tubercle at base of horizontal area;
– tergum I with basolateral carina ending well before spiracle foremargin;
– pygidial plate of female: setae not concealing integument;
– sternum I with simple median ridge basally;
– male sternum VIII with apicomedian projection;
– forecoxa black.

Sericophorus affinis (Hacker and Cockerell)

Figures 5–7.

Zoyphium affine Hacker and Cockerell, 1922:289, ♀, ♂. Lectotype: ♀, Australia: Queensland: Brisbane (QMB), designated as holotype by Hacker and Cockerell but not published as such in original description, **present designation by Pulawski**, examined by O. Lomholdt and W. Pulawski.— As *Sericophorus affinis*: Bohart and Menke, 1976:302 (new combination, listed); Cardale, 1985:251 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus affinis* is a small species (body length 3.5–6.0 mm), with an all black thorax (except pronotal lobe), propodeum, and gaster, contrastingly yellowish red or yellow legs (including all coxae), yellow clypeus (black dorsally in some males), and an obliquely ridged propodeal dorsum, finely sculptured posterolaterally (no lateral carinae on dorsum, no transverse or longitudinal ridges between side and posterior surface). It differs from similar species (except *confusus*) in having the clypeal middle lobe impunctate and glabrous adjacent to lamella (Fig. 5a-c). Subsidiary recognition features are: apical depressions of terga impunctate, clypeal lamella without teeth in male. Additionally, the clypeus is densely punctate mesodorsally, and in the male the two preapical flagellomeres combined are shorter than apical one. *Sericophorus confusus* is similar, but the clypeus is impunctate mesodorsally, and in the male the two preapical flagellomeres combined are as long as the apical one and the clypeal lamella has a small lateral tooth on each side.

Description.— Inner orbits almost parallel. Frontal punctures minute, less than one diameter apart; frontal line ill defined or absent. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.9× hindocellar width. Clypeus adjacent to lamella with narrow impunctate, glabrous area. Scutal punctures, at center, about one diameter apart, interspaces somewhat shiny; scutal flange widest apically, ending abruptly. Mesopleural punctures about one diameter apart beneath scrobe, interspaces unsculptured to slightly microsculptured. Propodeal dorsum with ridges that are conspic-

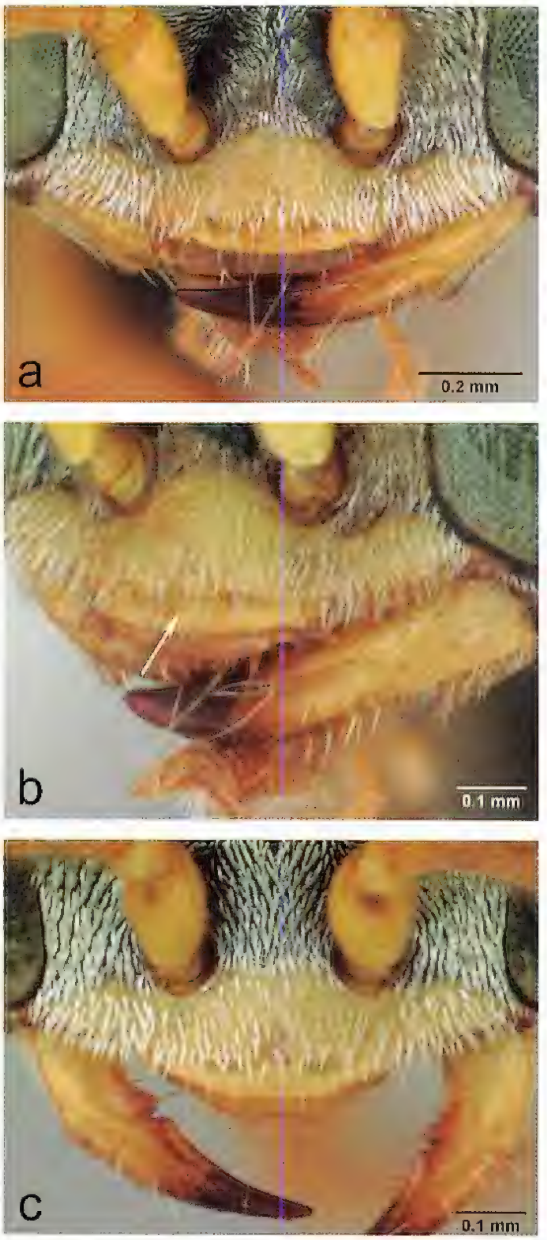

Figure 5. *Sericophorus affinis* (Hacker and Cockerell): a – female clypeus in frontal view; b – female clypeus in oblique lateral view (arrow indicates glabrous ventral area); c – male clypeus in frontal view.

uous anteriorly and minute posteriorly (most ridges reaching posterior margin, interspaces punctured), with sharp median carina in shallow, longitudinal depression; side shiny, with evanescent ridges or evenly microsculptured; posterior surface punctate except for median sulcus. Forewing vein M diverging from M+Cu basad of, but close to, cu-a; second submarginal cell conspicuously narrowed anteriorly or triangular. Terga with well-defined punctures, interspaces slightly microsculptured, shiny, punctures several diameters apart on horizontal portion of tergum I; apical depressions impunctate.

Setae of lower frons and clypeus silvery (light brassy in some males), concealing integument except on middle clypeal section; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum (integument glabrous apicomesally).

Head, thorax, propodeum, and gaster black except the following: clypeus yellow, brown along lobe free margin (black dorsally in some males); scape and pedicel yellow, flagellum brown, darkened dorsally; mandible yellow basally, dark brown apically; pronotal lobe reddish apically in female, yellow apically in most males, propleuron in some males with yellow spot. Legs (including coxae) reddish brown to yellow.

♀.— Orbital fovea ill defined, about as wide as half ocellocular distance. Dorsal length of flagellomeres I and II 0.9 × apical width; greatest length of flagellomere IX equal to 0.9 of apical width, of flagellomere X 1.7 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate largely concealing integument. Length 4.5–6.0 mm.

♂.— Clypeal lamella without lateral teeth. Dorsal length of flagellomere I 0.7 × apical width; of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with four of five rake spines. Sternum VIII: Fig. 6a. Genitalia: Fig. 6b. Length 3.5–4.9 mm.

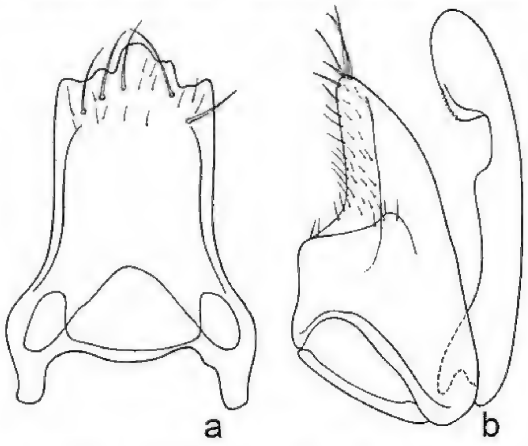

FIGURE 6. *Sericophorus affinis* (Hacker and Cockerell): a – male sternum VIII; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 7).— New South Wales, Queensland.

RECORDS.— AUSTRALIA: New South Wales: Spencer, 11–14 Jan (1 ♀, AEI); Warrumbungle National Park at 31°16′S 148°57′E, 17 Dec 1995 (5 ♀, ZMHU). **Queensland**: Brisbane, 15 Feb 1916 (1 ♀, QMB, lectotype of *Zoyphium affine*, designated as holotype by Hacker and Cockerell but not published in original description); Brisbane, 8 and 15 Feb 1916 (13 ♀, 9 ♂, BMNH, CAS, QMB, USNM, labeled as paratypes of *Zoyphium affine* but not published in original description),

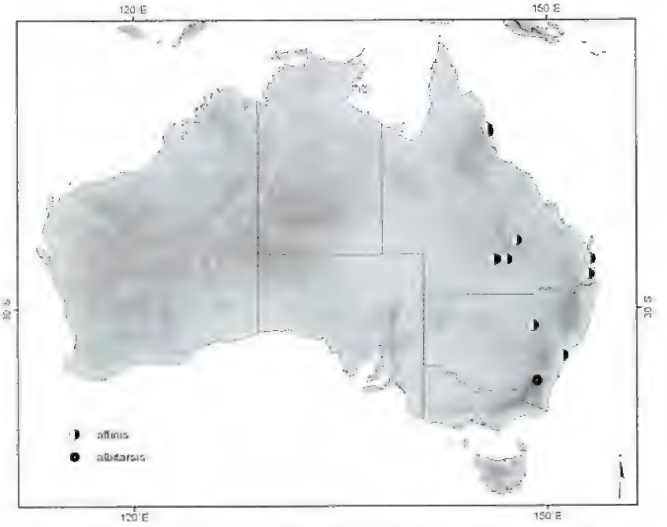

FIGURE 7. Collecting localities of *Sericophorus affinis* and *albitarsis*.

Charleville, 30 Oct 1968, on *Eucalyptus populnea* (1 ♂, UQIC); 7 mi. W Charleville, 1 Nov 1971, on *Eucalyptus* flowers (1 ♂, UQIC); Gordonvale at Mulgrave River, 12 Nov 1972 (1 ♀, FSCA); Kuranda, 1916 (1 ♀, 1 ♂, UCD); Morven, 3 Nov 1971, on *Eucalyptus* flowers (1 ♂, UQIC); Mount Moffatt in Carnarvon National Park at 25°01′S 147°47′E, 17 Nov 1995 (1 ♀, QMB); Noosa: sandstone bank, 25 Oct 1965 (1 ♀, UQIC); Redlynch, 30 Oct 1938 (1 ♀, BMNH).

***Sericophorus albitarsis* Lomholdt, sp. nov.**
Figures 7, 8.

NAME DERIVATION.— From Latin *albus*, white, and *tarsus*, a foot; with reference to this species whitish tarsi.

RECOGNITION.— The female of *Sericophorus albitarsis* (the male is unknown) has the setae appressed on the head and thorax, the thorax, propodeum, and gaster black (except the pale yellow pronotal lobe), and the clypeal lamella with only one lateral tooth. It differs from similar species in having the clypeus pale yellow with a dark median spot, and a small, pale yellow lateroventral spot on the frons. Subsidiary recognition features are: flagellum markedly clavate, mainly black, propodeal dorsum finely, obliquely ridged, and apical depression of tergum II punctate throughout. The body size is larger than in *argyreus* (length 5.8 mm rather than about 4.5 mm.)

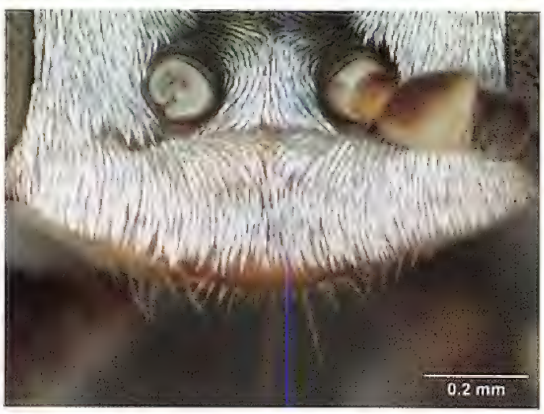

FIGURE 8. *Sericophorus albitarsis* Lomholdt, sp. nov.: female clypeus.

DESCRIPTION (based on holotype only).— Inner orbits almost parallel. Frontal punctures minute, nearly contiguous. Frontal line shiny, extending over middle of frons height. Ocellocular distance about equal to hindocellar width. Occipital carina not joining hypostomal carina. Scutal punctures averaging about one diameter apart near center, less than that near margins; interspaces unsculptured, shiny; scutal flange ending abruptly. Mesopleural punctures about one diameter apart; interspaces unsculptured, shiny. Propodeal dorsum with oblique carinae that are conspicuous near anterior margin but become gradually evanescent posterad (interspaces punctate), with median, glabrous sulcus that contains longitudinal carina and several transverse carinae; side punctate except unsculptured anteriorly; posterior surface punctate except for median sulcus. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular. Tergum I concave anteriorly; its horizontal area with punctures that average about one diameter apart (many punctures two or three diameters apart); apical depressions of tergum II punctate throughout.

Setae silvery, obscuring integument on frons; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following are pale yellow: clypeus and mandible (clypeus with median black spot, mandible dark brown apically), frons lateroventrally (next to clypeus), scape ventrally and apically, and pronotal lobe posteriorly; flagellum black, apical flagellomeres brown ventrally. Femora black, forefemur pale yellow apically; tibiae brown, partly yellow; tarsi yellowish white (apical tarsomeres brown).

♀.— Orbital fovea ill defined, shiny. Clypeal lamella slightly arcuate, with one lateral tooth (Fig. 8). Flagellum markedly clavate; dorsal length of flagellomere I about 0.7 × apical width, that

of flagellomere II 0.5 × apical width, that of flagellomere IX equal to 0.6 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with five rake spines. Setae of pygidial plate not concealing integument except apically. Length 5.7 mm.

♂.— Unknown.

Geographic distribution (Fig. 7).— Known only from Australian Capital Territory.

Records.— Holotype: ♀, **AUSTRALIA: Australian Capital Territory**: Canberra, 1969–1970, H.E. Evans and R.W Matthews (MCZ).

Sericophorus aliceae Turner

Figures 9–11.

Sericophorus aliceae Turner, 1936:542, ♀, ♂. Lectotype: ♀, Western Australia: Mingenew (BMNH), **present designation by W. Pulawski,** examined by O. Lomholdt and W. Pulawski.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:245 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus aliceae* is similar to *metallescens*. Both are predominantly metallic green, with erect setae on the upper frons and postocellar area, and have a ridged propodeal dorsum (punctate between ridges). In *aliceae*, the episcrobal area is finely, longitudinally ridged, the clypeal middle lobe narrower (Fig.9a, b), and the rake spines of the forebasitarsus are longer than the forebasitarsus apical width. In *metallescens*, the episcrobal area is not ridged, the clypeal middle lobe is wider (Fig. 116a, b), and the rake spines of the fore-basitarsus are no longer than the forebasitarsus apical width. Also, the scutal punctures are finer in *metallescens* than in *aliceae*. *Sericophorus minutus* is also similar, but it has the femora, tibiae, and tarsi reddish brown (forefemur darkened basally) and the propodeal dorsum finely rugose on each side of the median sulcus, whereas in *aliceae* and *metallescens* the femora are metallic green and at least the mid- and hindtibiae are black, and the propodeal dorsum is ridged.

Description.— Frontal punctures averaging about one diameter apart; frontal line reaching midocellus in female, not reaching in male. Ocellocular distance equal to 0.9–1.0 × hind-

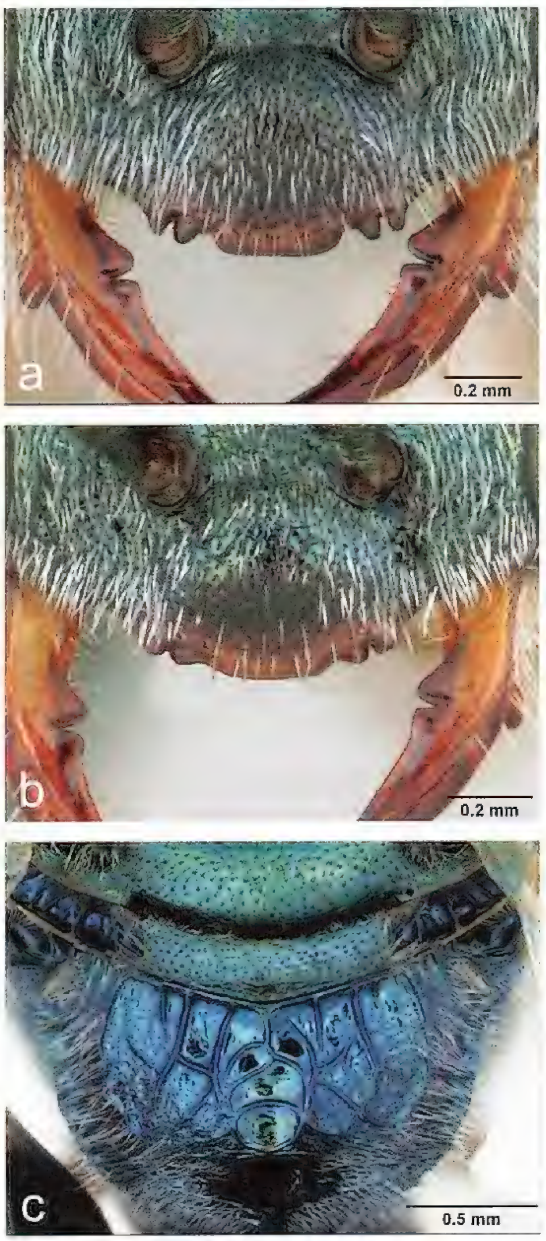

Figure 9. *Sericophorus aliceae* Turner: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female propodeum in dorsal view.

ocellar width; interocellar area convex adjacent to hindocellus, concave mesally. Pronotal collar not quite reaching level of scutum. Scutal punctures well defined, several diameters apart near center; scutal flange gradually narrowing posterad; admedian line deeply impressed, notaulus with transverse ridges. Mesopleural punctures averaging 2–3 diameters apart near center; episcrobal area finely ridged longitudinally. Propodeal dorsum conspicuously, irregularly ridged (Fig. 9c), with median sulcus that is crossed by curved ridges (sulcus ill-defined in female, well defined in male); side and posterior surface ridged; side separated from posterior surface by longitudinal, zigzagging ridge that is crossed by several oblique ridges. Forewing vein M interstitial with cu-a; second submarginal cell conspicuously narrowed anteriorly or triangular. Forecoxal punctures several diameters apart. Rake spines of forebasitarsus longer than forebasitarsus width. Horizontal area of tergum I with punctures that are about 2–3 diameters apart mesally (impunctate along apical margin); anterior declivity of tergum I concave.

Setae silvery, not concealing integument on lower frons and clypeus; erect on upper frons and postocellar area, on interocellar area as long as 0.9 × midocellar width; erect on scutum and propodeal dorsum; on forefemoral venter up to 1.2 × as long as midocellar venter.

Head, thorax, propodeum, femora, and gaster metallic green except mandible reddish yellow basally and dark brown apically, female pronotal lobe brownish, female flagellum largely brown, male flagellum only ventrally so, and female gastral segment VI black. Tibiae and tarsi black except foretibia and apical foretarsomere reddish brown.

♀.— Orbital fovea black, width less than half ocellocular distance. Dorsal length of flagellomere I about 1.2 × apical width, that of flagellomere II 0.9 × apical width, that of flagellomere IX equal to 0.6 × apical width, of flagellomere X 1.1 × basal width. Forebasitarsus with six or seven rake spines. Setae of pygidial plate not obscuring integument. Length 7.0–8.0 mm.

♂.— Clypeal lamella without lateral teeth. Forebasitarsus with four rake spines. Dorsal length of flagellomere I about 1.0 × apical width, that of flagellomere II 0.8 × apical width, that of flagellomere IX equal to 0.8 × apical width, of flagellomere X 1.1 × basal width. Sternum VIII emarginate apically (Fig. 10a). Genitalia: Fig. 10b. Length 5.0–6.0 mm.

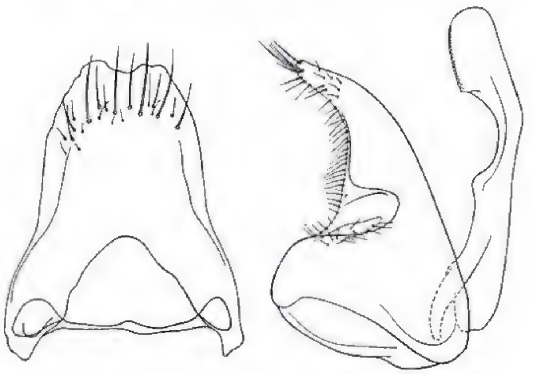

FIGURE 10. *Sericophorus aliceae* Turner: a – male sternum VIII; b – male genitalia in lateral view.

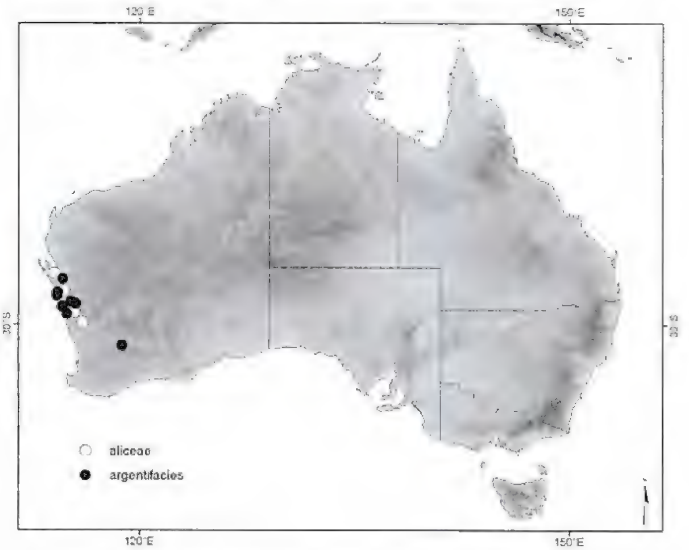

FIGURE 11. Collecting localities of *Sericophorus aliceae* and *argentifacies*.

GEOGRAPHIC DISTRIBUTION (Fig. 11).— Western Australia.

Records.— **AUSTRALIA: Western Australia:** Coorow, 4 Nov 1958 (1 ♀, ANIC); 11 km SE Eurardy Homestead at 27°39′17″S 114°43′25″E, 15–17 Nov 2000 (1 ♂, WAMP); Geraldton, 9 Oct 1931 (1 ♂, CAS; 1 ♀, 1 ♂, MCZ); Kalbarri, 15–19 Sept 1981 (1 ♀, ANIC), 21 Sept–8 Oct 1981 (1 ♀, ANIC) and 22–27 Sept 1981 (1 ♂, ANIC); Mingenew, 15–22 Oct 1935 (2 ♀, 1 ♂, BMNH, lectotype and paralectotypes of *aliceae*); 6 miles W Mullewa, 1 Oct 1969 (1 ♀, MCZ); Nilemah Station 50 mi. S Denham, 8–9 Oct 1969 (1 ♀, CAS).

***Sericophorus ambonensis* Pulawski, sp. nov.**
Figures 12, 13.

Name derivation.— *Ambonensis*, a Neolatin adjective derived from Ambon Island, on which the holotype was collected.

Recognition.— *Sericophorus ambonensis* resembles the New Guinean *subalaris* in having an expanded subalar carina and practically glabrous horizontal part of tergum I (with only a few sparse, microscopic punctures), contrasting with the basal area of tergum II. It differs in having the posterior mandibular margin convex next to the notch (Fig. 12b), whereas the margin is straight in *subalaris*. Subsidiary recognition features are: clypeus, thorax, propodeum, femora, and gaster black, without metallic luster (pronotal collar with pair of narrow, pale yellow spots, pronotal lobe dark reddish), setae appressed on head and thorax, frons densely punctate, clypeus not emarginate and without elevation, pronotal collar not emarginate and reaching level of scutum, axilla not expanded laterally, propodeal dorsum finely punctate and without sublateral carina, three submarginal cells present, forecoxa largely black, hindtibia not swollen, basolateral carina of tergum I ending well before the anterior margin of the spiracle, tergum I with impunctate apical depression, sternum I with no projection, and female tergum VI densely setose.

Description (based on holotype only).— Frontal punctures minute, shallow, about one diameter apart. Frontal line ill defined but extending to midocellus. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.8 × hindocellar width. Free margin of clypeal lamella minimally convex, practically straight except concave adjacent to lateral teeth. Posterior mandibular margin convex adjacent to notch (Fig. 12b). Pronotal collar reaching level of scutum. Scutal punctures minute, about two diameters apart; scutal flange gradually narrowing posterad. Mesopleural punctures about two diameters apart beneath scrobe; interspaces unsculptured. Subalar area expanded, as in *subalaris* (see Fig. 196b). Propodeal dorsum minutely punctate, with median carina in shallow, glabrous depression; side unsculptured; posterior surface obliquely ridged (except for median sulcus). Forewing vein M diverging from

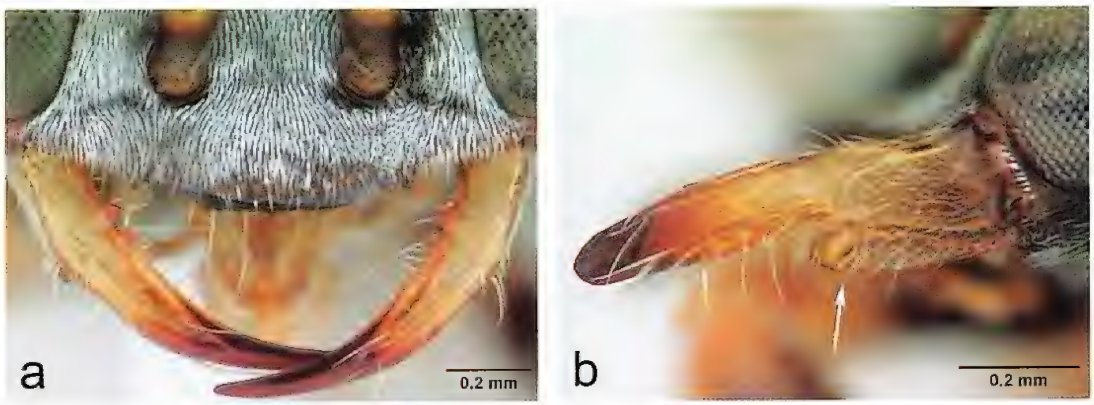

Figure 12. *Sericophorus ambonensis* Pulawski, sp. nov.: a – female clypeus in frontal view; b – female mandible in lateral view (arrow indicates convex part of ventral margin).

M+Cu basad of cu-a; second submarginal cell triangular. Horizontal area of tergum I unsculptured; apical depressions of terga I-V impunctate.

Setae of lower frons and clypeus silvery, obscuring integument at certain angles; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except flagellum reddish brown ventrally, pronotal collar with pair of narrow, pale yellow spots, pronotal lobe dark reddish posteriorly. Femora black; foretibia yellowish brown, foretarsus brown (apical tarsomere reddish brown); midtibia brown dorsally, yellowish brown ventrally, midtarsus brown; hindtibia and hindtarsus dark brown.

♀.— Orbital fovea absent. Free margin of clypeal lamella straight, slightly concave laterally (Fig. 12a). Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 1.1 × apical width, of flagellomere X 1.7 × basal width. Forebasitarsus with five rake spines. Setae of pygidial plate concealing integument near apex. Length about 7.1 mm.

♂.— Unknown.

Geographic distribution (Fig. 13).— Ambon Island.

Records.— Holotype: ♀ **INDONESIA: Maluku Province:** Ambon Island: no specific locality, 70 m. alt., 15 Apr 1961, [A.M.R.] Wegner (RMNH).

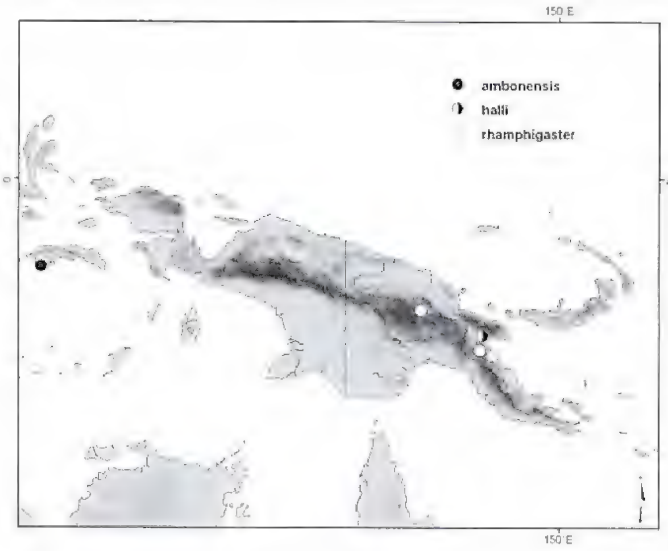

Figure 13. Collecting localities of *Sericophorus ambonensis*, *halli*, and *rhamphigaster*.

Sericophorus argentifacies Lomholdt, sp. nov.

Figures 11, 14, 15.

Derivation of name.— From the Latin words *argentum*, silver, and *facies*, face; a noun in apposition to the generic name; with reference to the silvery facial pubescence.

Recognition.— *Sericophorus argentifacies* has erect setae on the upper frons and postocellar area, a concave anterior declivity of tergum I, a black frons, the scutum either black or with a vestigial bluish luster, and contrastingly metallic blue terga. In addition, the propodeal side is separated from posterior surface by a series of oblique ridges. In the female, the middle clypeal section is slightly convex throughout. In the male, flagellomeres III-V are evenly convex ventrally (Fig. 14c). *Sericophorus viridis* is similar, but unlike that species the setae of *argentifacies* are about as long as 0.8 of midocellar width on the interocellar area and 0.3 × midocellar width on the scutum (rather than about 1.0–1.2 × and 0.7–1.0 × midocellar width, respectively), the mesopleural punctures are ill defined, several diameters apart under the scrobe (rather than well defined, averaging no more than two diameters apart), and the median sulcus of the propodeal dorsum has a dull lateral margin (rather than sharp).

Description.— Frons swollen near center; frontal punctures averaging about one diameter apart, more than one diameter apart near top of swelling; frontal line short, conspicuous on frontal swelling; interspaces conspicuously microsculptured; interocellar area convex adjacent to hind-

ocellus, concave mesally. Ocellocular distance equal to 1.3 × hindocellar width. Scutal punctures near center varying from about one to 2–3 diameters apart; scutal flange gradually narrowing toward apex. Mesopleural punctures ill defined, several diameters apart beneath scrobe. Scutellum markedly convex. Propodeal dorsum punctate, adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, well-defined, glabrous, longitudinal sulcus; longitudinal sulcus with several transverse carinae (at least in basal half), in most specimens with median carina in basal half; side minutely punctate (except anteriorly), delimited from posterior surface by oblique ridges that are not crossed by longitudinal ridge; posterior surface minutely punctate except for median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell conspicuously narrowed anteriorly, almost triangular in some specimens. Tergal punctures less than one diameter apart; anterior declivity of tergum I markedly concave anteriorly.

Setae silvery on lower frons and clypeus, not concealing integument; erect on upper frons and postocellar area, on interocellar area about 0.8 × as long as midocellar width; on scutum nearly erect, about 0.3 × as long as midocellar width; suberect on propodeal dorsum.

Head black except clypeal lamella reddish in most females, female antenna reddish brown (apical flagellomere black at least apically), male antenna dark brown (middle flagellomeres reddish at least ventrally), mandible reddish brown, dark brown apically (male mandible black basally). Pronotum black, reddish laterally in many females; pronotal lobe reddish in female; scutum either black or with vestigial bluish luster; mesopleuron, scutellum, metanotum, and propodeum with bluish luster that varies from vestigial to conspicuous, metanotum reddish brown laterally in some specimens. Legs bright reddish brown. Terga with conspicuous blue luster except apical tergum brown.

FIGURE 14. *Sericophorus argentifacies* Lomholdt, sp. nov.: a – female clypeus in frontal view; b; male clypeus in frontal view; c – male antenna.

♀.— Lateral teeth of clypeal lamella conspicuous (Fig.14a). Orbital foveae absent. Dorsal length of flagellomeres I and II about 1.2–1.3 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X equal to basal width. Forebasitarsus with 6–8 rake spines. Setae of pygidial plate concealing integument apically. Length 8.5–9.0 mm.

♂.— Lateral tooth of clypeal lamella acute (Fig. 14b). Flagellomeres II-VI convex ventrally (Fig. 14c), II and VI only slightly so; dorsal length of flagellomere I about 1.1 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X about 0.9–1.0 × basal width. Forebasitarsus with five rake spines. Sternum VIII emarginate apically (Fig.15a). Genitalia: Fig. 15b. Length 6.0–7.5 mm.

Geographic distribution (Fig. 11).— Western Australia.

Records.— Holotype: ♀, **AUSTRALIA: Western Australia:** Geraldton, Spelding Park, Bluff Point, 5 Sept 1973, N. McFarland (BMNH). Paratypes: **AUSTRALIA: Western Australia:** Balline Station at 27°59′S 114°13′E, 24–25 July 1979, A.M. and M.J. Douglas (2 ♂, CAS; 10 ♂, WAMP); Dongarra, 26 Sept–3 Oct 1935, R.E. Turner (1 ♀, 1 ♂, BMNH; 1 ♀, CAS); East Yuna Nature Reserve 34 km W of Mullewa, 14–26 August 1985, T.F. Houston (2 ♂, WAMP); Kalbarri National Park, 1 Aug 1983, B.B. Lowery (1 ♀, ANIC); 30 mi. E Merredin, 16 Sept 1962, E.S. Ross and D.O. Cavagnaro (1 ♀, CAS); Mullewa, 14 and 18 Sept 1931, W.M. Wheeler (5 ♀, MCZ); 13 km S of Wannoo at 26°49′S 14°37′E, 21–23 Aug 1988, T.F. Houston (1 ♀, 1 ♂, CAS; 2 ♀, 1 ♂, WAMP).

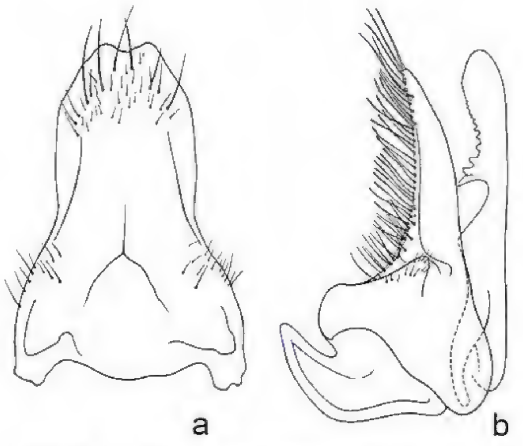

Figure 15. *Sericophorus argentifacies* Lomholdt, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view.

Sericophorus argyreus (Hacker and Cockerell)

Figures 16, 17.

Zoyphium argyreum Hacker and Cockerell, 1922:286, ♀. Holotype: ♀, Australia: Queensland: Brisbane: Birkdale (QMB), examined by O. Lomholdt and W. Pulawski.— As *Sericophorus argyreus*: Bohart and Menke, 1976:302 (new combination, listed); Cardale, 1985:251 (in catalog of Australian Sphecidae).

Recognition.— The female of *Sericophorus argyreus* (the male is unknown) is characterized by the small size (length 4.3–4.5 mm) and the absence of erect setae on the upper frons and postocellar area. It can be differentiated from similar species by its minutely, densely punctate frons, the presence of only one lateral tooth at the clypeal lamella, clypeus without elevation, obliquely ridged propodeal dorsum, punctate throughout apical depressions of terga, and by its coloration: clypeus yellow, frons, thorax (except pronotal lobe), propodeum, and gaster black, coxae and femora black (fore- and midfemora each with apical pale yellow spot).

Description.— Inner orbits parallel (Fig. 16a). Frontal punctures minute, less than one diameter apart; interspaces practically unsculptured; frontal line well defined, not extending above frontal midheight. Ocellocular distance equal to 1.1 × hindocellar width. Scutal punctures minute, averaging less than one diameter apart, interspaces slightly microsculptured; scutal flange ending abruptly. Mesopleural punctures larger than those on scutum, averaging about one diameter at center; interspaces unsculptured. Propodeal dorsum finely, obliquely ridged, with glabrous median impression (Fig. 16c), and in paratype with median carina (carina absent in holotype); side unsculptured anteriorly, with minute punctures posteriorly; posterior surface punctate except for median sulcus. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular. Tergal punctures minute, those on horizontal area of tergum I about one to two diameters apart; apical depressions punctate.

Setae silvery, largely concealing integument on lower frons and clypeus, appressed on upper

frons, postocellar area, and scutum, suberect on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following: clypeus pale yellow; flagellum missing in specimens examined but "obscurely fulvous beneath" according to Hacker and Cockerell, 1922:286; mandible pale yellow basally, reddish brown apically; pronotal lobe pale yellow. Femora black, fore- and midfemora with pale yellow apical spot; tibiae dark brown, foretibia with wide pale yellow stripe. Tarsi pale yellow.

♀.— Orbital fovea absent. Clypeal lamella arcuate, with one lateral tooth (Fig. 16b). Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.5 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with five rake spines. Setae of pygidial plate partly obscuring integument. Length about 4.3–4.5 mm.

♂.— Unknown.

Geographic distribution (Fig. 17).— Australian Capital Territory and Queensland.

Records.— AUSTRALIA: Australian Capital Territory: Black Mountain, 8 Jan 1988 (1 ♀, UCD). **Queensland**: Brisbane: Birkdale, 15 Feb 1916 (1 ♀, QMB, holotype of *Zoyphium argyreum*, head missing), 17 Feb 1914 (1 ♀, BMNH, paratype of *Zoyphium argyreum*, antennae and forelegs missing).

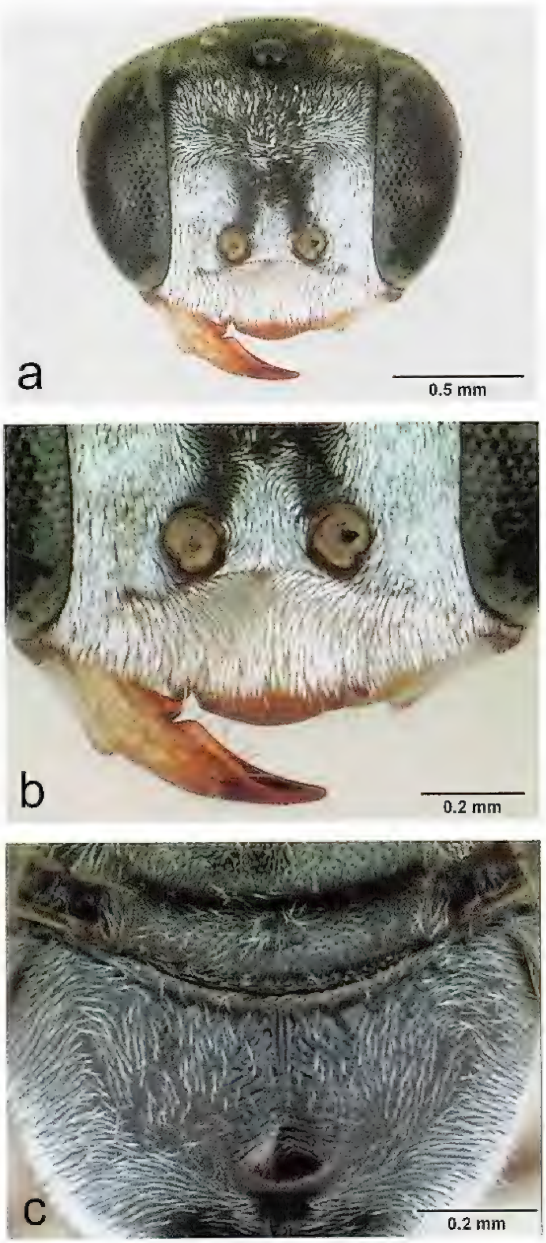

Figure 16. *Sericophorus argyreus* (Hacker and Cockerell), paratype: a – female head in frontal view; b – female clypeus in frontal view; c – female propodeum in dorsal view.

Sericophorus arrernte Pulawski, sp. nov.

Figures 17, 18.

Name derivation.— *Arrernte* is the name of an Australian Aborigine tribe in whose territory this species occurs; a noun in apposition to the generic name.

Recognition.— *Sericophorus arrernte* is a small species (length about 5.1 mm), with the setae appressed on the postocellar area and scutum. As in *axillaris* and *pectinatus*, the horizontal part of the axilla is expanded, its lateral margin is convex, overhanging the depressed lateral part (Fig. 18b), and the female pygidial plate is sparsely punctate basally and mesally (punctures at least two diameters apart). Unlike those two species, the propodeal dorsum of *arrernte* is densely punctate (punctures less than one diameter apart) rather than areolate or ridged, the scutum is coppery shiny (rather than black), and the setae of tergum I completely conceal the integument on the ter-

gum's anterior half (rather than not concealing). Unlike *axillaris*, punctures of terga I and II are less than one diameter apart (rather than several diameters apart). Unlike *pectinatus*, the orbital fovea is well defined (rather than lacking), the mesopleural punctures are about one diameters apart (rather than several diameters apart behind the episternal sulcus), the rake spines are short (the apical spine of foretarsomere II is shorter than foretarsomere III, rather than longer) and the flagellum is reddish brown (rather than all or largely black).

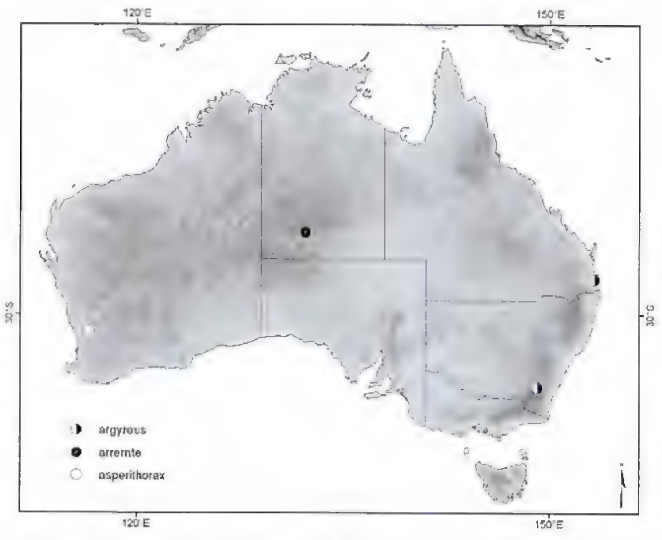

FIGURE 17. Collecting localities of *Sericophorus argyreus*, *arrernte*, and *asperithorax*.

DESCRIPTION (based on holotype only).— Frontal punctures less than one diameter apart. Frontal line not extending beyond frontal midheight. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.6 × hindocellar width. Pronotal collar not reaching level of scutum. Scutal punctures less than one diameter apart; scutal flange ending abruptly. Horizontal part of axilla acutely expanded (Fig. 18b), overhanging adjacent depressed lateral portion. Mesopleural punctures, near center, about one diameter apart (less than that on preepisternal and episcrobal areas); episternal sulcus practically not foveolate. Propodeal dorsum punctate (punctures less than one diameter apart), foveolate along anterior margin, with shallow, glabrous median sulcus that contains median carina and several transverse carinae; side punctate, punctures less than one diameter apart; posterior surface finely ridged except for median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly. Oblique anterior portion of tergum I shiny, with punctures that average several diameters apart, horizontal area dull, with punctures practically contiguous; basolateral carina attaining level of spiracle; apical depressions of terga I and II punctate.

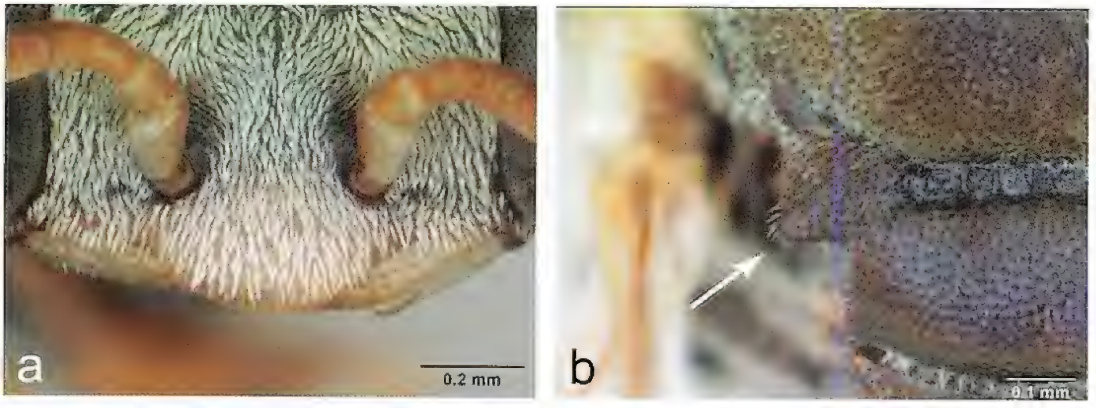

FIGURE 18. *Sericophorus arrernte* Pulawski, sp. nov.: a – female clypeus in frontal view; b – left portion of female mesothorax (arrow indicates axilla).

Setae of lower frons and clypeus silvery, totally obscuring integument; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum; totally obscuring integument on anterior half of horizontal portion of tergum I.

Head, thorax, propodeum, and gaster black except clypeal middle section, scape, pedicel, and mandible pale yellow (mandible brown at very apex), flagellum reddish brown, and scutum with coppery shine. Fore- and midfemora brown basodorsally, yellow apicoventrally, hindfemur reddish brown, yellow apically; tibiae and tarsi pale yellow, mid-and hindtibiae reddish ventrally.

♀.— Orbital fovea well defined, about as wide as half ocellocular distance. Clypeal lamella with one, ill-defined lateral tooth (Fig. 18a). Dorsal length of flagellomere I 0.8 × apical width, of flagellomere II 0.7 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with six rake spines. Punctures of pygidial plate several diameters apart basomedially and medially, setae not concealing integument. Length 5.1 mm.

♂.— Unknown.

Geographic distribution (Fig. 17).— Known from one locality in southern part of Northern Territory.

Records.— Holotype: ♀, **AUSTRALIA: Northern Territory**: Areyonga, 8 Dec., year and collector not indicated but probably H.K. Townes (AEI).

Sericophorus asperithorax (Rayment)

Figures 17, 19.

Anacrucis asperithorax Rayment, 1955a:57, ♀. Holotype: ♀, Western Australia: Bolgart (NMV), examined by O. Lomholdt and W. Pulawski.— As *Sericophorus asperithorax*: R. Bohart and Menke, 1976:302 (new combination, listed); Cardale, 1985:251 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus asperithorax* has the setae erect on the upper frons and postocellar area, the head, thorax (except pronotal collar), propodeum, and gaster black (without metallic green or blue luster), and femora, tibiae, and tarsi reddish brown. Also, the ocellocular distance is 1.6 × hindocellar width. It differs from other species with these characteristics (*littoralis*, *nigrescens*, *setulosus*) in having the propodeal side separated from the posterior surface (at least dorsally) by a series of minute, oblique ridges (except that the uppermost ridge is markedly larger), and the propodeal dorsum has a median, longitudinal carina in a shallow depression, without median transverse carinae. In the other three species, the propodeal side is separated from the posterior surface by a series of conspicuous, oblique ridges (the uppermost of which is not larger than the others), and the propodeal dorsum has a well-defined longitudinal sulcus that contains a basal longitudinal carina and several transverse carinae.

Description.— Head wide in front view (Fig. 19a). Frons concave ventrally, transversely swollen at about one third of its height. Frontal punctures about 2–3 diameters apart between swelling and midocellus. Frontal line bisecting swelling, but not extending below or above it. Ocellocular distance equal to 1.6 × hindocellar width. Interocellar area convex adjacent to hindocellus, concave mesally. Scutal punctures minute, several diameters apart; scutal flange gradually narrowing posterad. Mesopleural punctures averaging about 2–3 diameter apart near center. Propodeal dorsum punctate (most interspaces merging into minute ridges), with shallow median depression and longitudinal carina, without transverse carinae; side punctate, separated from posterior surface by minute oblique ridges (at least dorsally) with uppermost ridge markedly larger; posterior surface minutely, transversely ridged except for median sulcus. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular. Tergum I slightly concave anteriorly, punctures of horizontal area several diameters apart mesally; apical depressions of terga I and II largely impunctate mesally.

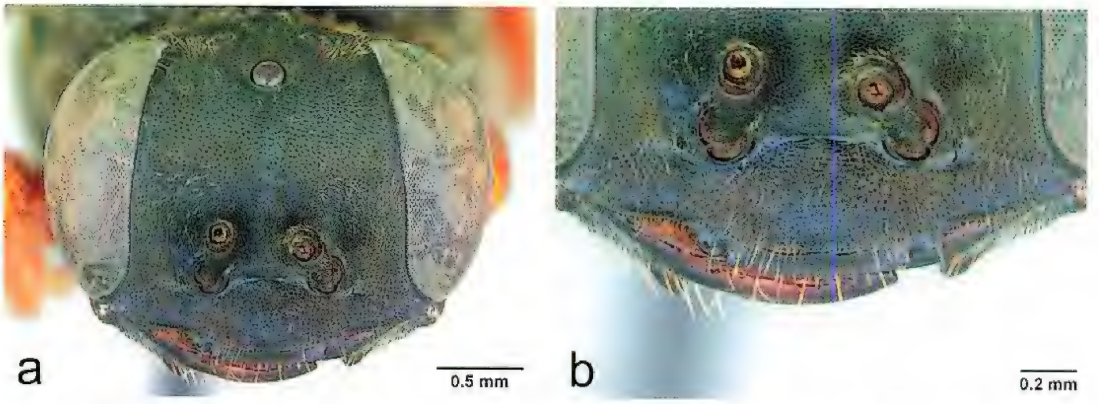

FIGURE 19. *Sericophorus asperithorax* (Rayment), holotype: a – female head in frontal view; b – female clypeus in frontal view.

Setae of lower frons and clypeus silvery, sparse, not obscuring integument; erect on upper frons, postocellar area, and scutum; on interocellar area about as long as 0.6 × midocellar width; on scutum dark, suberect, 0.4–0.5 × as long as midocellar width; erect on propodeal dorsum.

Head, thorax, propodeum, and gaster black (without metallic luster) except mandible dark reddish mesally and pronotal collar with pair of pale yellow spots. Femora, tibiae, and tarsi reddish brown.

♀.— Orbital fovea well defined, about as wide as half ocellocular distance. Clypeus with obtuse median carina in ventral third in paratype; clypeal lamella with inner lateral tooth ill defined (Fig. 19b). Dorsal length of flagellomere I 1.2 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 1.1 × apical width, of flagellomere X 1.5 × basal width. Forebasitarsus with six rake spines. Setae of pygidial plate partly concealing integument. Length 10.0–12.0 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 17).— Known from one locality in Western Australia.

RECORDS.— **AUSTRALIA: Western Australia**: Bolgart, 3 Sept 1947 (1 ♀, NMV, holotype of *Anacrucis asperithorax*) and Nov 1951 (1 ♀, NMV, paratype).

Sericophorus aurifrons Lomholdt, sp. nov.

Figures 20–22.

NAME DERIVATION.— *Aurifrons*, from Latin words *aurum*, gold, and *frons*, forehead; a noun in apposition, with reference to the golden frontal pilosity of this species.

RECOGNITION.— *Sericophorus aurifrons* has the setae appressed on the upper frons and postocellar area, the clypeus and the pronotal collar are not emarginate mesally, the forewing has three submarginal cells and vein M diverging from M+Cu basad of cu-a, and the basolateral carina of tergum I is inconspicuous, ending well before anterior margin of spiracle. Furthermore, the frons, clypeus, thorax, propodeum, and forecoxa are black, without metallic luster or yellow markings, the forefemur is black (reddish brown apically), the gaster is reddish brown, and the frontal setae do not obscure the integument. In the male, sterna III-VI have conspicuous, erect setae in addition to those at the base of apical depressions (Fig. 20c).

DESCRIPTION.— Frontal punctures ill defined, about one diameter apart. Frontal line ending at about frontal midheight. Ocellocular distance 0.9–1.0 × hindocellar width. Clypeal lamella arcuate (Fig. 20a, b). Scutal punctures less than one diameter apart; scutal flange ending abruptly. Meso-

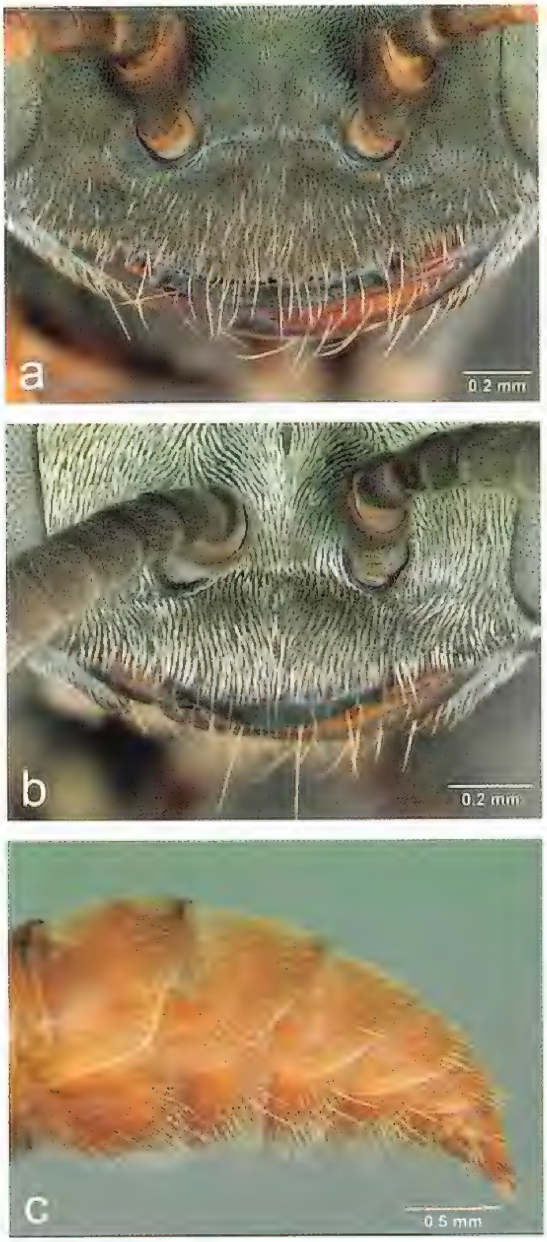

FIGURE 20. *Sericophorus aurifrons* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view; c – male gaster in lateral view.

pleural punctures about one diameter apart. Propodeal dorsum with ridges that are conspicuous near foremargin and become gradually evanescent posterad (interspaces punctate), mesally with glabrous impression that contains longitudinal carina, apicomesally unsculptured, shiny on each side of carina; side punctate and ridged, partly unsculptured in some males; posterior surface punctate except for median sulcus, unsculptured dorsomesally. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular. Horizontal area of tergum I with punctures about one diameter apart anteriorly, several diameters apart posteriorly; apical depression impunctate (except basally). Apical depression of tergum II impunctate mesally.

Setae appressed on upper frons, postocellar area, and scutum; not obscuring integument on frons and clypeus, golden in most specimens but only weakly so in some; appressed, oriented anterad on propodeal dorsum.

Head, thorax, and propodeum black, nonmetallic except most of flagellum yellowish brown in female and some males and mandible reddish brown mesally. Femora black (reddish brown apically) in female, in male forefemur black (reddish brown apically), midfemur black in about basal half (remainder reddish brown), hindfemur reddish brown except black basally; tibiae and tarsi reddish brown. Gaster reddish brown, tergum I black basally.

♀.— Orbital fovea ill defined, wider than half ocellocular distance. Inner tooth of clypeal lamella slightly thicker than outer tooth (Fig. 20a). Dorsal length of flagellomeres I and II

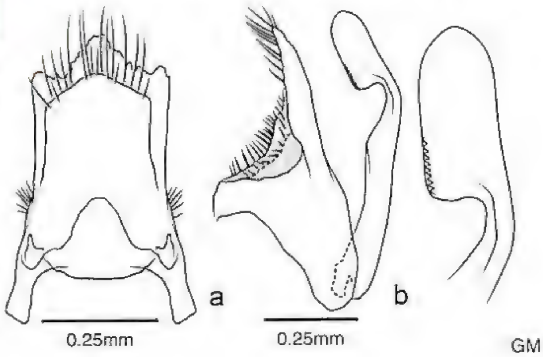

FIGURE 21. *Sericophorus aurifrons* Lomholdt, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

about 1.0 × apical width; greatest length of flagellomere IX equal to 0.8 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with six to eight rake spines. Setae of pygidial plate obscuring integument. Length 5.8–6.7 mm.

♂.— Clypeal lamella with obtuse lateral tooth (Fig. 20b). Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.7 × basal width. Forebasitarsus with five or six rake spines. Sterna III-VI with conspicuous erect setae (Fig. 20c). Sternum VIII with apicomedian point (Fig. 21a). Genitalia: Fig. 21b. Length 3.0–4.5 mm.

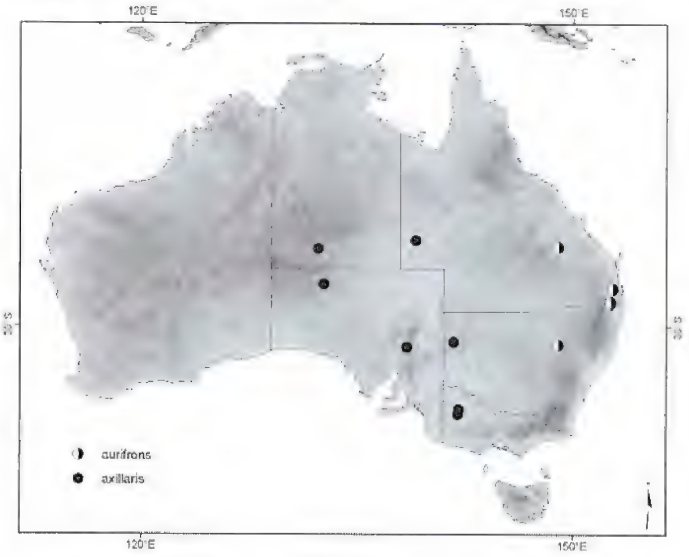

FIGURE 22. Collecting localities of *Sericophorus aurifrons* and *axillaris*.

GEOGRAPHIC DISTRIBUTION (Fig. 22).— New South Wales, Queensland.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **Queensland**: Bald Mountain area, 3,000–4,000 ft. via Emu Vale, 26–30 Jan 1973, I. Naumann (UQIC). PARATYPES: **AUSTRALIA: New South Wales**: Warrumbungle National Park at 31°16′S 148°57′E, 17 Dec 1995, M.E. Irwin (1 ♂, ZMHU); Woodenbong: Bald Mountain State Forest, 18 Nov 1972, G.B. Fairchild (1 ♀, FSCA). **Queensland**: Blackdown Tableland in Expedition Range, 6 Jan 1976, G. Daniels (1 ♀, AMS); Mount Glorious, 12 and 30 Dec, no year or collector but probably H.K. Townes (2 ♂, AEI), 1–7 Dec (1 ♂, CAS); Mount Nebo, 1–7 Dec, no year or collector but probably H.K. Townes (1 ♂, CAS).

Sericophorus axillaris Lomholdt, sp. nov.

Figures 22–24.

NAME DERIVATION.— *Axillaris*, a Neolatin adjective derived from classical Latin *axilla*, which is greatly enlarged in this species.

RECOGNITION.— *Sericophorus axillaris* is a small species (length about 3.6–4.1 mm), with the setae appressed on the postocellar area and scutum. As in *arrernte* and *pectinatus*, the horizontal part of the axilla is expanded, with the lateral margin convex, overhanging the depressed part (Fig. 23c), and the female pygidial plate is sparsely punctate basally and mesally (puncture at least two diameters apart). Unlike those two species, the propodeal dorsum of *axillaris* is ridged (rather than areolate or punctate). Also, unlike *arrernte*, the scutum is black (rather than coppery shiny), the punctures of terga I and II are several diameters apart (rather than less than one diameter apart), and the setae of tergum I do not conceal the integument (rather than concealing the anterior part of horizontal portion). Unlike *pectinatus*, the orbital fovea is well defined (rather than lacking), the mesopleural punctures are about one diameter apart (rather than several diameters apart behind the episternal sulcus), the foretarsal rake is short (the apical spine of foretarsomere II is shorter than tarsomere III, rather than longer), and the flagellum is reddish brown (rather than dark brown to black dorsally and yellow to brown ventrally in female, all black in male).

DESCRIPTION.— Head unusually broad, width 1.45 × height in female, 1.20 × in male (mea-

sured from clypeus ventral margin to top of vertex). Frontal punctures ill defined, minute, about one diameter apart; interspaces dull, conspicuously microsculptured. Frontal line ill defined, not extending into frons dorsal half. Antennal socket separated from clypeal free margin by socket width. Ocellocular distance equal to 0.9 × hindocellar width. Clypeus densely, uniformly punctate to base of lamella; lamella arcuate, with no lateral incision; lateral tooth not differentiated (Fig. 23a, b). Scutal and mesopleural punctures about one diameter apart, interspaces practically unsculptured, shiny; scutal flange abruptly narrowing apically. Axilla markedly expanded, overhanging its depressed lateral part, its lateral margin convex (Fig. 23c). Propodeal dorsum rugose, with diverging ridges next to foremargin, with median carina but without median sulcus; side ridged or largely microsculptured, separated from posterior surface by longitudinal, zigzagging carina; posterior surface ridged except for median sulcus. Forewing vein M diverging from M+Cu distally to cu-a; second submarginal cell narrowly open anteriorly or triangular. Tergum I with basolateral carina ending at level of spiracle foremargin; horizontal part with minute punctures that are 2–3 to several diameters apart; anterior declivity slightly concave; apical depressions of terga I and II largely unsculptured, shiny.

Setae golden, strictly appressed, almost completely concealing integument of frons and clypeus in female, but not in male; appressed on upper frons, postocellar area, and scutum; subappressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following: clypeus reddish brown near lobe free margin, most of middle clypeal section yellowish brown in female from Northern Terri-

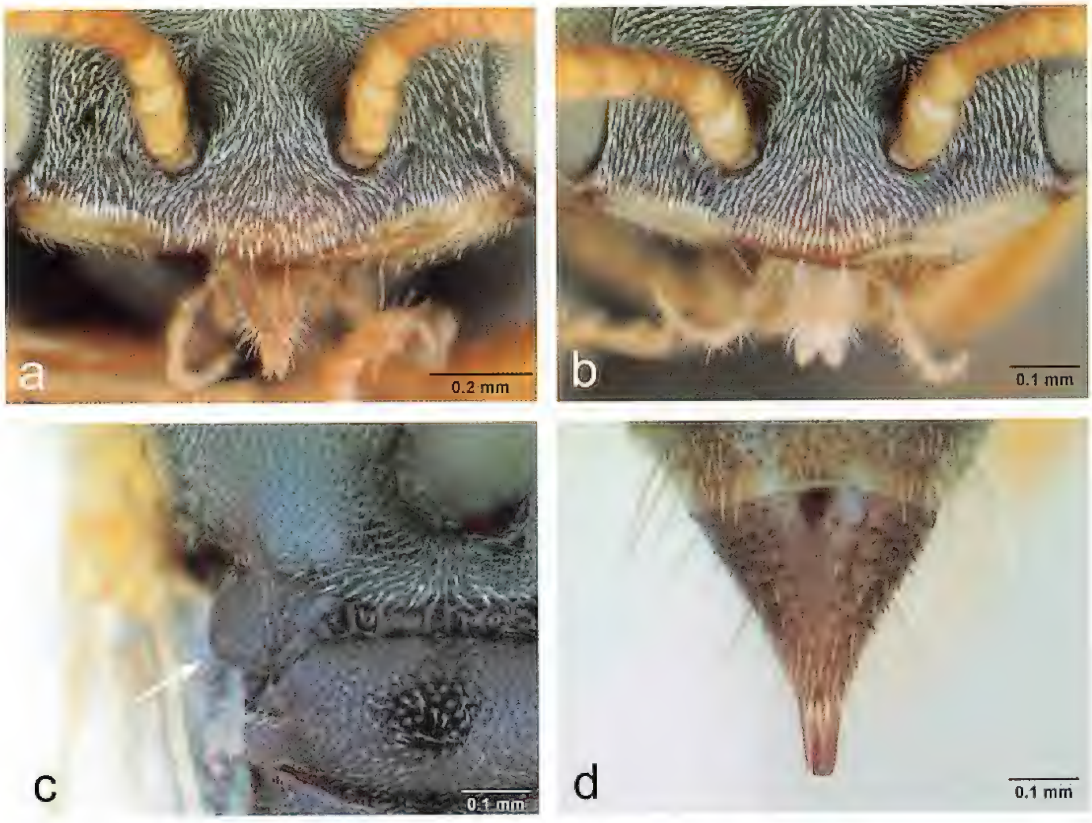

FIGURE 23. *Sericophorus axillaris* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view; c – portion of female thorax in dorsal view (arrow indicates axilla); d – tergum VI of female.

tory; mandible pale yellow (brown apically); scape and pedicel pale yellow, flagellum yellowish brown; tegula yellowish brown; wing veins yellowish. Femora and tibiae yellowish brown, tarsi pale yellow.

♀.— Orbital fovea long, dull, sharply delimited mesally, its width less than half ocellocular distance. Dorsal length of flagellomere I about 1.0 × apical width, that of flagellomere II 0.7 × apical width (ventral length of both flagellomeres smaller than apical width); greatest length of flagellomere IX equal to 0.8 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with 4–6 slender, translucent rake spines (longest spine about 1.8 × basitarsus width). Pygidial plate basally and mesally with punctures that are several diameters apart (Fig. 23c). Length 3.8–4.1 mm.

♂.— Dorsal length of flagellomere I about1.0 × apical width; that of flagellomere II about 0.8 × apical width; greatest length of flagellomere IX equal to 0.8 × apical width, of flagellomere X 1.1 × basal width. Forebasitarsus with three rake spines. Sternum VIII: Fig. 24a. Genitalia: Fig. 24b. Length 3.6–4.0 mm.

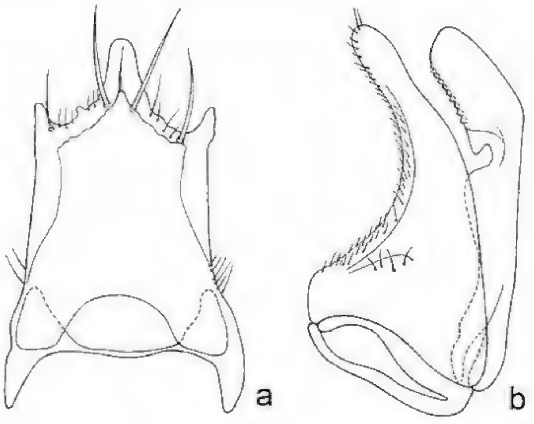

FIGURE 24. *Sericophorus axillaris* Lomholdt, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 22).— Southeastern Australia, southern part of Northern Territory.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **South Australia**, Edeowie Homestead near Wilpena Pound, 29 Oct 1972, on flowers of *Heterodendron oleifolium*, H.E. Evans (USNM). PARATYPES: **AUSTRALIA**: **New South Wales**: Fowles Gap Research Station at 31°05′S 141°42′E, J.C. Cardale, 29 Nov–2 Dec 1981 (1 ♀, ANIC), 8–9 Dec 1982 (1 ♂, ANIC). **Northern Territory**: ca 200 km SW Alice Springs at 24°36.5′S 132°17.4′E, 15 Mar 2008, V. Ahrens and W.J. Pulawski (1 ♀, CAS). **Queensland**: Sandringham Station 55 km NW Bedourie at 24°03′S 139°03′E, 1979–1980, S. Morton (2 ♀, gaster missing in one, ANIC). **South Australia**: 4 miles south of Maynard's Bore, Everard Park, 5 Nov 1970, E. Matthews (1 ♀, SAM). **Victoria**: 5–15 miles south of Rainbow, 21–22 Feb 1970, H.E. Evans and R.W. Matthews (1 ♂, MCZ); Yaapeet, 18–22 Feb 1970, H.E. Evans and R.W. Matthews (1 ♂, MCZ).

Sericophorus barakula Pulawski, sp. nov.

Figures 25, 26.

NAME DERIVATION.— Named after the Barakula State Forest, Queensland, where the holotype was collected; a noun in apposition to the generic name.

RECOGNITION.— *Sericophorus barakula* has the setae erect on the upper frons and postocellar area and shares a unique coloration with *rufus*: the head (except a part of the clypeus and the appendages), thorax, and propodeum are black, whereas the gaster, femora predominantly, tibiae, and tarsi are reddish brown. Unlike *rufus*, the clypeal lamella is wide in *barakula*, the distance between the inner teeth being 1.3 × clypeal midlength (rather than equal to clypeal midlength).

DESCRIPTION (based on holotype only).— Frontal punctures averaging about 1–2 diameters apart. Frontal line reaching anterior ocellus. Ocellocular distance equal to hindocellar width. Interocellar area convex adjacent to hindocellus, concave mesally. Pronotal collar ending slightly below level of scutum. Scutal punctures averaging about 1–2 diameters apart; scutal flange gradually narrowing posterad. Mesopleural punctures averaging about three diameters apart at center; inter-

spaces microareolate, slightly shiny. Propodeal dorsum punctate, adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, well-defined, glabrous, longitudinal sulcus; the latter with several transverse carinae and wide, triangular, longitudinal carina in basal half; side practically unsculptured, separated from posterior surface by oblique carinae that are crossed by zigzagging, longitudinal carina; posterior surface punctate except for median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly. Tergum I concave anteriorly, punctures of horizontal area averaging about 2–3 diameters apart; apical depressions of terga I and II punctate except impunctate near hindmargin.

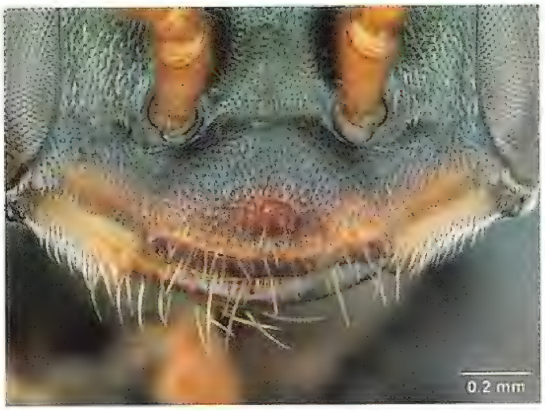

FIGURE 25. *Sericophorus barakula* Pulawski, sp. nov.: female clypeus in frontal view.

Setae of lower frons and clypeus silvery, not obscuring integument; erect on upper frons, postocellar area, and scutum; on interocellar area about as long as 0.7 × midocellar width; on scutum dark, suberect, 0.7 × as long as midocellar width; suberect, oriented anterad on propodeal dorsum.

Head, thorax, and propodeum black except ventral half of clypeus and antenna reddish brown and mandible yellowish basally, dark brown apically. Femora, tibiae, tarsi, and gaster reddish brown (forefemur black in basal half, midfemur black basally).

♀.— Orbital fovea ill defined, wider than half ocelloocular distance. Clypeal lamella broad, distance between inner teeth 1.3 × clypeal midlength (Fig. 25). Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.1 × basal width. Forebasitarsus with six rake spines. Setae of pygidial plate not concealing integument except apically. Length 6.8 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 26).— Known from one locality in Queensland.

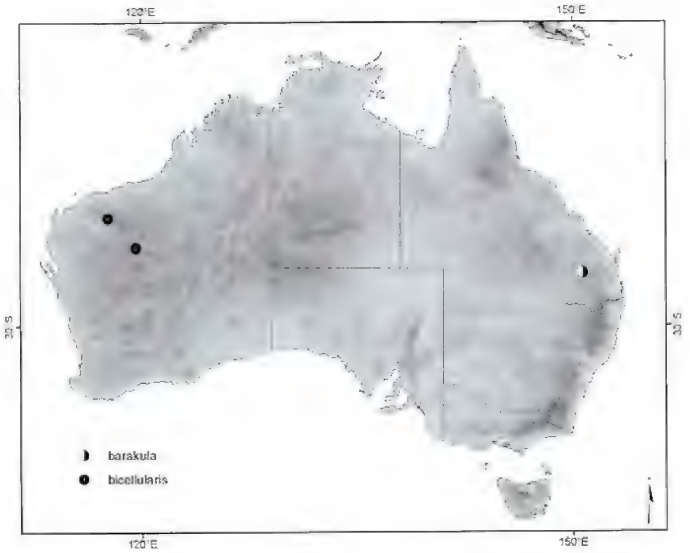

FIGURE 26. Collecting localities of *Sericophorus barakula* and *bicellularis*.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **Queensland**: Auburn Road at Hellhole Creek in Barakula National Forest at 26°20′S 150°42′E, 13–15 Oct 2004, C. Burwell and S. Wright (QMB).

***Sericophorus bicellularis* Pulawski, sp. nov.**
Figures 26–28.

NAME DERIVATION.— *Bicellularis*, from Latin prefix *bi-*, double, and *cellularis*, cellular; with reference to the presence of two submarginal cells only.

RECOGNITION.— Like *frontalis*, *bicellularis* has only two submarginal cells in the forewing. Unlike that species, however, the second submarginal cell is narrow (the length of the radial margin is markedly less than the height, Fig. 27c), the thorax and propodeum are black, and the forewing apex has a dark spot (spot faint in the male). In *frontalis*, the second submarginal cell is unusually wide (the length of the radial margin is about equal to the maximum height), the thorax and propodeum are largely reddish brown, and the forewing is uniformly transparent. Apparently the reduction of the cell numbers was achieved through the disappearance of forewing vein 1r-m in *frontalis*, and of vein 2r-m in *bicellularis*.

DESCRIPTION.— Frontal punctures shallow, about one diameter apart (yellow, lateroventral area in female with a few, sparse punctures). Antennal socket separated from clypeal free margin by less than two socket widths. Frontal line short, present only below frons midheight. Ocellocular distance equal to hindocellar width. Scutal punctures averaging about one diameter near center, up to about two diameters apart on each side of center; scutal flange ending abruptly. Mesopleural punctures 1–2 diameters apart at center, 2–3 diameters apart in one male. Propodeal dorsum punctate, with ridges emerging from basal margin, in female and one male also emerging from median carina (the latter located in shallow, glabrous depression); side mainly unsculptured, with a few, sparse punctures posteroventrally; without longitudinal carina between side and posterior surface; posterior surface punctate except for median sulcus. Forewing vein M interstitial with cu-a or diverging from M+Cu basad of cu-a; only two submarginal cells present; second submarginal cell narrowly open anteriorly (length of radial margin markedly less than height). Horizontal area of tergum I with punctures averaging about 2–3 diameters apart; apical depression impunctate; apical depression of tergum II largely impunctate mesally.

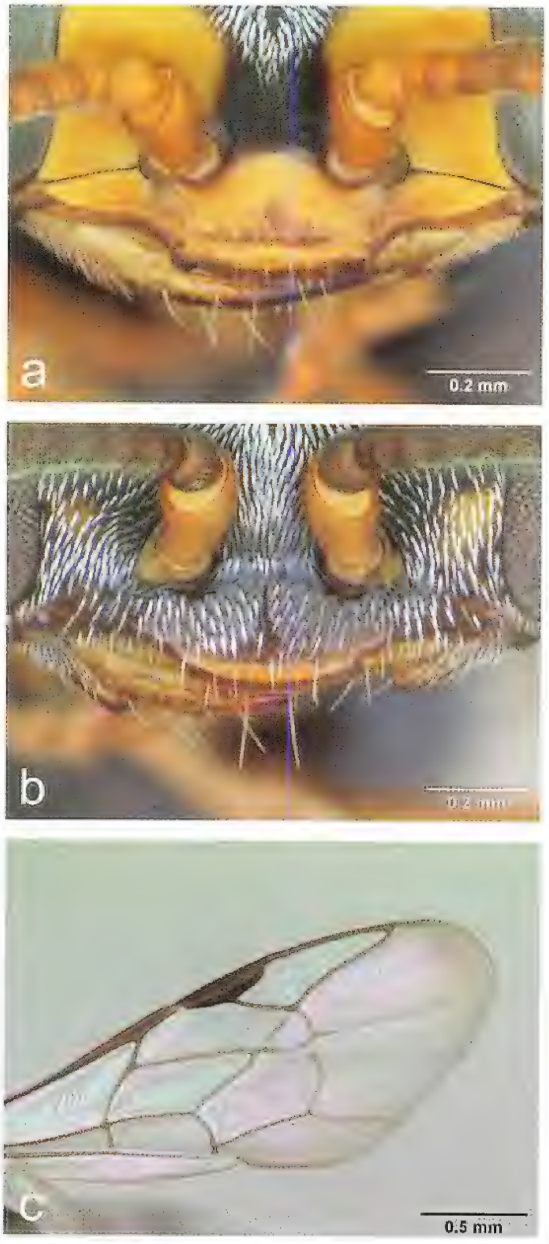

FIGURE 27. *Sericophorus bicellularis* Pulawski, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female forewing.

Setae of lower frons and clypeus silvery, not obscuring integument (yellow, lateroventral portion of frons largely glabrous in female); appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum (setae absent mesally).

Head, thorax, propodeum, and gaster black except the following: mandible yellow in basal half, in female clypeus and large lateroventral spot on frons intensely yellow (frontal spot extending above frontal midheight near orbit), in male clypeus along lobe free margin and in one specimen small spot on frons near orbit, at level of dorsal margin of antennal socket, pronotal lobe pale yellow posteriorly in female, yellowish brown in male; scape yellow, flagellum yellowish brown with yellow spots in female, dark brown in male. Forecoxa yellow (brownish in one male), femora, tibiae, and tarsi pale reddish brown, female foretibia and foretarsus yellowish brown.

♀.— Orbital fovea absent. Free margin of clypeal lamella minimally convex (Fig. 27a). Dorsal length of flagellomere I 0.9 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with five rake spines. Setae of pygidial plate concealing integument preapically. Length 4.6 mm.

♂.— Clypeal lamella without lateral teeth or with one small lateral tooth (Fig. 27b). Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.4 × basal width. Posterior mandibular margin slightly convex between condyle and notch. Forebasitarsus with five or six rake spines. Sternum VIII obtusely pointed apicomesally, point slightly emarginate in one specimen (Fig. 28a). Genitalia: Fig. 28b. Length 4.1–4.2 mm.

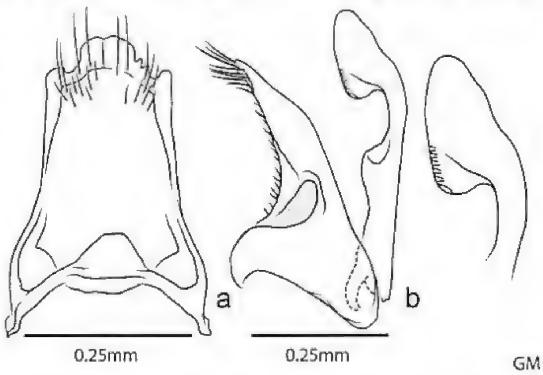

FIGURE 28. *Sericophorus bicellularis* Pulawski, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

GEOGRAPHIC DISTRIBUTION (Fig. 26).— Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Western Australia**: 36 km N Tom Price on Hamersley Iron Road at 22°32.5′S 117°37.2′E, 23 Apr–4 May 2003, F.D. Parker and M.E. Irwin (ANIC). PARATYPE: **Western Australia**: 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003, F.D. Parker and M.E. Irwin (1 ♂, ANIC), 7–18 May 2003 (1 ♂, ANIC; 1 ♂, CAS, 1 ♂, USU).

Sericophorus bicolor F. Smith

Figures 29–31.

Sericophorus bicolor F. Smith, 1873c:405, ♀. Holotype or syntypes: ♀, Australia: Western Australia: Swan River (BMNH), examined by O. Lomholdt.— Froggatt, 1892:221 (in catalog of Australian Hymenoptera); Dalla Torre, 1897:578 (in catalog of world Sphecidae); Turner, 1914:351 (in revision of Australian *Sericophorus*); Rayment, 1955a:25 (in revision of Australian *Sericophorus*); Bohart and Menke, 1976:302 (listed); Cardale, 1985:245 (in catalog of Australian Sphecidae).— As *Tachyrrhostus bicolor*: Kohl, 1885a:430 (new combination, in checklist of world *Tachyrrhostus*).

Sericophorus brisbanensis Rayment, 1955a:26, ♂. Holotype: ♂, Australia: Queensland: Brisbane (QMB), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt**.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:245 (in catalog of Australian Sphecidae).

Sericophorus castaneus Rayment, 1955a:27, ♀. Holotype: ♀, Australia: Queensland: Brisbane (QMB), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:245 (in catalog of Australian Sphecidae).

Sericophorus hackeri Rayment, 1955a:34, ♂, junior secondary homonym of *Sericophorus hackeri* (Cockerell, 1932). Holotype: ♂, Australia: Queensland: Brisbane (QMB), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**

Sericophorus cockerelli Menke *in* Bohart and Menke, 1976:302. Substitute name for *Sericophorus hackeri* Rayment, 1955. **New synonym by O. Lomholdt.**— Cardale, 1985:246 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus bicolor* can be recognized by the following combination: the frons and in most specimens the thorax and propodeum have a dark blue to violet metallic luster, whereas the gaster and at least tibiae and tarsi are contrastingly reddish brown. In addition, the setae of the upper frons and postocellar area are erect, and the propodeal side is separated from posterior surface by a zigzagging, longitudinal carina. *Sericophorus scintillans* is similar, but in *bicolor* the frontal punctures, near the center, are more than one diameter apart in female, about one diameter apart in male, and the sculpture is not obscured by pilosity, the ocellocular distance is equal to 1.0 × hindocellar width, the mesopleuron is not obscured by pilosity, the mid- and hindfemora are black in many specimens (but reddish brown in some), and the terga are all reddish brown. In *scintillans* the frontal punctures are less than one diameter apart, partly obscured by pilosity, the ocellocular distance is equal to 0.8 × hindocellar width, the upper mesopleuron is nearly completely concealed by setae, the mid- and hindfemora are nearly all reddish brown, and terga I-III have green or blue metallic spots.

Description.— Inner orbits almost parallel. Frontal punctures, near center, more than one diameter apart in female, about one diameter apart in male; frontal line extending to midocellus, well defined in male; female frons with shallow impression near center. Ocellocular distance equal to hindocellar width. Clypeal lamella arcuate. Scutal punctures, at center, varying from nearly contiguous to about one diameter apart; scutal flange gradually narrowing posterad. Mesopleuron punctate in female (punctures varying from one to several diameters apart below scrobe), in male punctate and longitudinally ridged; episternal sulcus unusually deep, conspicuously foveolate. Propodeal dorsum punctatorugose in female, rugose in male, adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, longitudinal sulcus; longitudinal sulcus slightly widening posteriorly, delimited laterally and posteriorly by sharp carina, crossed by one or a few transverse carinae (Fig. 29c); side ridged, delimited from posterior surface by conspicuous, zigzagged longitudinal carina intersecting transverse ridges; posterior surface irregularly ridged, with unusually wide median sulcus (at least as wide dorsally as midocellar width), delimited laterally by conspicuous carina. Forewing vein M interstitial with cu-a; second submarginal cell markedly narrowed anteriorly or triangular. Terga minutely punctate; horizontal part of tergum I with punctures that are several diameters apart mesally; apical depressions of terga I and II impunctate adjacent to hindmargin. Anterior declivity of tergum I shallowly concave. Sternum I with two longitudinal ridges basally.

Setae conspicuously erect on upper frons and postocellar area, on interocellar area about 0.7–0.8 × as long as midocellar width; erect but markedly shorter on scutum; suberect, oriented anterad on propodeal dorsum (basal and median impressions glabrous).

Frons blue or greenish blue; clypeus black, with faint bluish luster dorsally, reddish brown along free margin in females from Milparinka, New South Wales, Ellery Creek Big Hole, Northern Territory, and Copper's Creek, South Australia; gena with violet blue luster. Antennae reddish brown, flagellum largely darkened in some specimens. Mandible yellowish reddish brown, apex dark. Thorax and propodeum with dark blue to violet metallic luster except pronotal lobe dark brown (practically all thorax and propodeum black in female from Bilpin area, New South Wales).

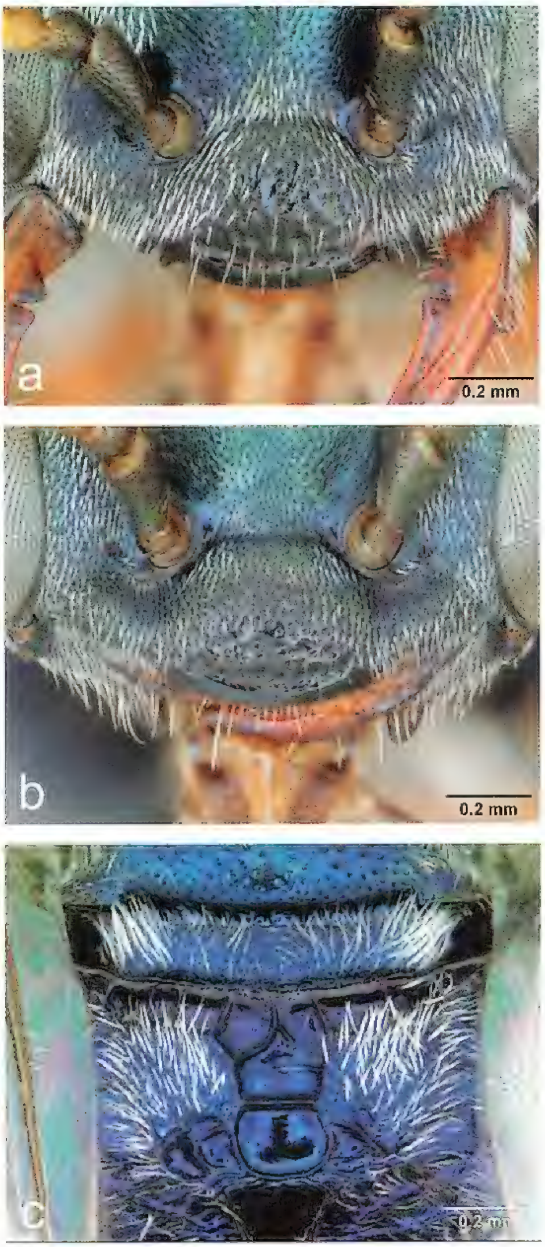

FIGURE 29. *Sericophorus bicolor* F. Smith: a – female clypeus; b – male clypeus; c – female propodeum in dorsal view.

Femora black (red in females from Milparinka and Copper's Creek), tibiae and tarsi reddish brown. Gaster reddish brown.

♀.— Orbital fovea wider than half ocellocular distance, contrasting with adjacent area by lack of metallic luster. Clypeus: Fig. 29a. Dorsal length of flagellomere I about 1.1 × apical width, of flagellomere II about 0.8 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X about 1.3–1.4 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate not concealing integument. Length 5.0–7.2 mm.

♂.— Clypeal lamella with acute to obtuse tooth laterally (Fig. 29b). Dorsal length of flagellomere I 0.9 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with three or four rake spines. Sternum VIII slightly emarginate apically (Fig. 30a). Genitalia: Fig.30b. Length 4.5–5.5 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 31).— All Australia except not found in Victoria and Tasmania.

RECORDS.— **AUSTRALIA**: **Australian Capital Territory**: Casuarina Sands in Canberra, 6 Oct 1999 (1 ♀, CAS). **New South Wales**: Bilpin near Kurrajong, 26–28 Nov 1978 and 7 Dec 1981 (3 ♀, 2 ♂, AMS; 1 ♀, 1 ♂, CAS); 20 mi. S Milparinka, 17 Nov 1949 (3 ♀, ANIC; 1 ♀, UCD); Pooncarie, ex *Hakea leucoptera*, 26 Nov 1991 (1 ♀, AMS). **Northern Territory**: Areyonga, 12 Oct (1 ♀, AEI); Ellery Creek Big Hole in West McDonnell National Park at 23°46.7′S 133°04.4′E, 9 Mar 2008

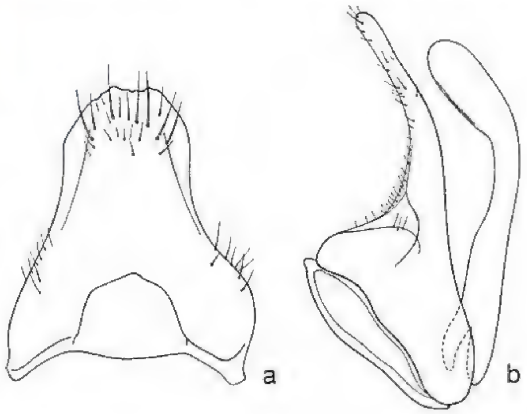

FIGURE 30. *Sericophorus bicolor* F. Smith: a – male sternum VIII; b – male genitalia in lateral view.

(1 ♀, CAS); Keep River National Park at 15°57′33″S 129°01′44″E, 31 May–3 June 2001 (1 ♀, USU), and 15°47′49″S 129°06′31″E, 11–20 June 2001 (1 ♂, USU). **Queensland**: Brisbane, 8 Feb 1916 (2 ♂, QMB, holotypes of *castaneus* and *brisbanensis*), 15 Feb 1916 (1 ♂, QMB, incorrectly labeled as paratype of *hackeri* by Rayment, not part of original description), and 12 Feb 1918 (1 ♀, AMNH; 1 ♂, QMB, holotype of *hackeri* Rayment); Brisbane: Blunder Creek, 1–7 Nov 1979 (1 ♂, UQIC); Bribie Island, 15 Nov 1972 (1 ♀, FSCA); N Caloundra, 24 Oct 1965, on *Leptospermum* sp. (1 ♂, UQIC); Heathlands at 11°45′S 142°35′E, 22 Nov–8 Dec 1992 (1 ♀, ANIC); 3 km NE Mount Webb at 15°03′S 145°09′E, 1–30 Oct 1980 (1 ♂, ANIC). **South Australia**: Cooper's Creek (1 ♀, SAM). **Western Australia**: 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 18–21 May 2003 (1 ♂, CAS); Swan River (BMNH, holotype of *bicolor*).

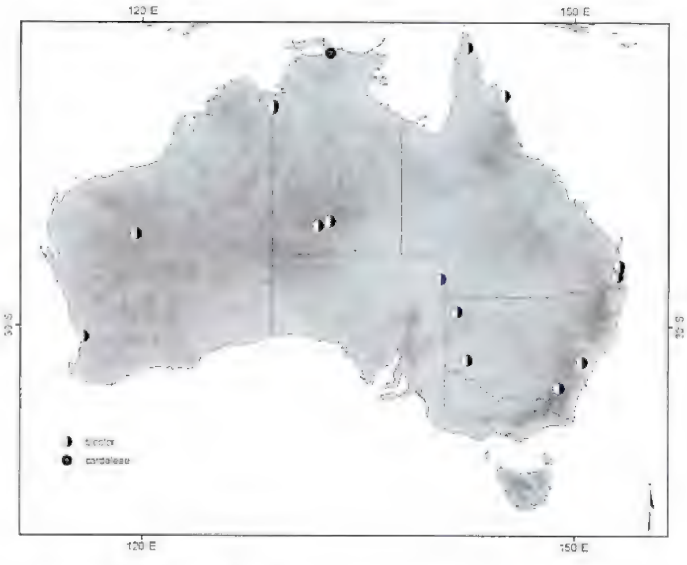

FIGURE 31. Collecting localities of *Sericophorus bicolor* and *cardaleae*.

***Sericophorus cardaleae* Lomholdt, sp. nov.**
Figures 31–32.

NAME DERIVATION.— Named after Josephine C. Cardale who authored a catalog of Australian Sphecidae and who collected the type material.

RECOGNITION.— Like *multipictus*, *cardaleae* has three obtuse, longitudinal carinae on sternum I, but it lacks an arcuate sulcus behind the carinae (sulcus present in *multipictus*). Subsidiary recognition features are: clypeal median section elevated, separated from the free margin by glabrous, vertical area, free margins of both elevation and lobe emarginate (emargination deeper than in *multipictus*); propleuron prominently angulate posterolaterally; pronotum and metanotum pale yellow, and scutellum reddish brown.

DESCRIPTION.— Frontal punctures averaging less than one diameter apart; frontal line short, well defined. Ocellocular distance equal to 1.0 × hindocellar width. Clypeal lamella broadly emarginate mesally, median lobe with elevation whose free margin is also broadly emarginate (Fig. 32a-d), with glabrous area between elevation free margin and lamella (elevation overhanging lamella in larger males; glabrous area short, vertical in female, markedly longer, concave in male). Propleuron prominently angulate posterolaterally (as in Fig. 165e). Scutal punctures averaging about one diameter apart near center; scutal flange ending abruptly. Mesopleural punctures about one diameter apart; interspaces unsculptured, shiny (integument largely concealed by vestiture); episternal sulcus practically not foveolate. Propodeal dorsum punctate (interspaces shiny), with shallow, narrow median impression that contains somewhat ill-defined longitudinal carina; side punctate except unsculptured anteriorly; posterior surface punctate except mesally. Forewing vein M diverging from M + Cu basad of cu-a; second submarginal cell triangular. Punctures of tergum I about 2–3 diameters apart on center of horizontal area; basolateral carina expanded but not elongate, end-

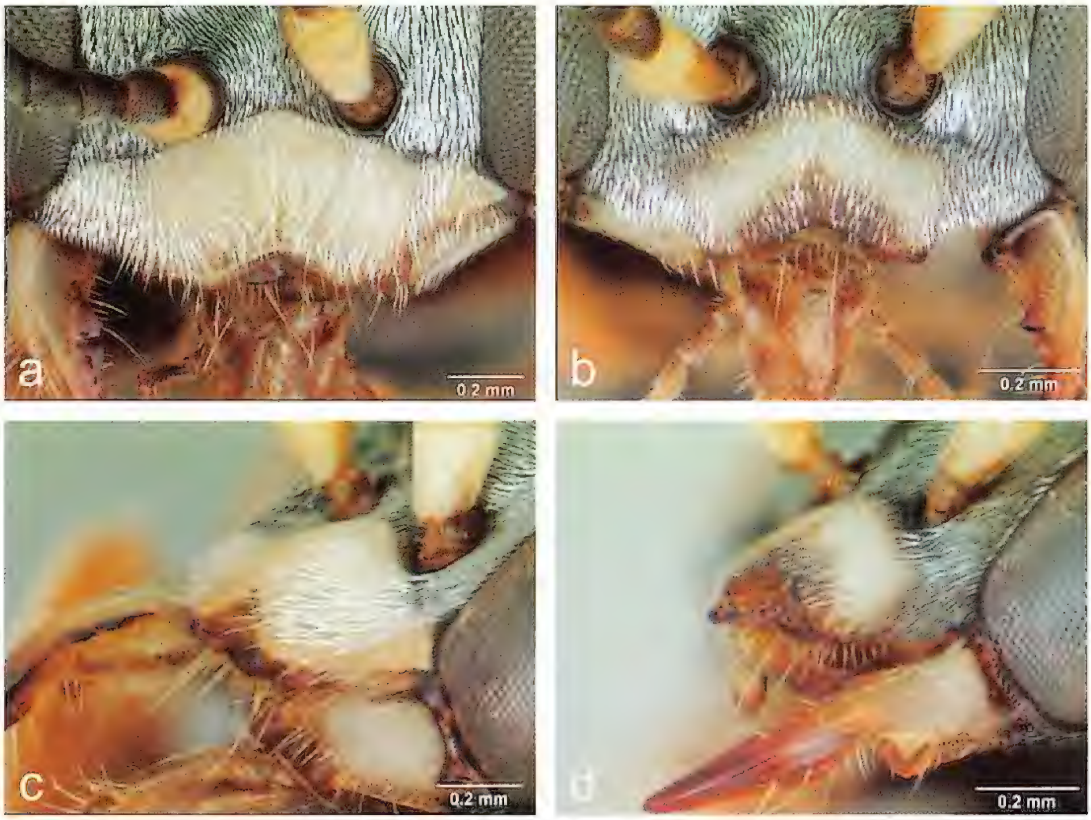

FIGURE 32. *Sericophorus cardaleae* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female clypeus in lateral oblique view; d – male clypeus in lateral oblique view.

ing before spiracle foremargin. Sternum I thickened basally, with three longitudinal, obtuse carinae on thickening.

Setae silvery, completely concealing integument on lower frons laterally and on lateral clypeal section; appressed on upper frons, postocellar area, and scutum; on propodeal dorsum almost appressed, oriented obliquely toward midline.

Head black except the following are yellow: scape, clypeus (ventral area of elevation brown and clypeal lateral section black in male), mandible basally (dark brown apically); and flagellum reddish brown ventrally (two or three basal flagellomeres all black). Thorax and propodeum black except the following: pronotum pale yellow; pronotal lobe reddish brown, pale yellow apically; scutellum reddish brown; metanotum pale yellow. Forewing slightly infumate. Fore- and midfemora tricolored: reddish brown dorsally, pale yellow ventrally (except near base), black in-between on posterior surface; hindfemur reddish brown, in female with small pale yellow apical spot on outer surface; tibiae reddish brown, foretibia pale yellow on outer surface; tarsi brown. Tergum I reddish brown; terga II-V black, with translucent apical depressions, terga II and III narrowly reddish brown before apical depressions; female pygidial plate and male tergum VII partly reddish brown.

♀.— Width of orbital fovea more than half ocellocular distance. Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 1.2 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with seven translucent rake spines. Setae of pygidial plate largely obscuring integument in apical half. Length 7.5–8.0 mm.

♂.— Clypeal lamella angulate laterally (Fig.32b). Dorsal length of flagellomeres I and II 1.0 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.4 × basal width; flagellomere II slightly concave ventrally, flagellomere III slightly concave ventrally except for preapical tubercle. Forebasitarsus with three or four rake spines (two or three subbasal, one apical). Length 5.5–7.0 mm. Sternum VIII: Fig. 33a. Genitalia: Fig. 33b.

GEOGRAPHIC DISTRIBUTION (Fig. 31).— Known from one locality in Top End of Northern Territory.

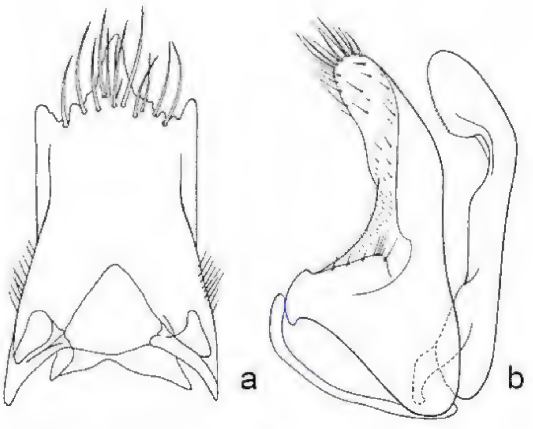

FIGURE 33. *Sericophorus cardaleae* Lomholdt, sp. nov. a – male sternum VIII; b – male genitalia in lateral view.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Northern Territory**: Cooper Creek 19 km SE Mount Borradaile at 12°06′S 133°04′E, 5–6 June 1972, J.C. Cardale (ANIC). PARATYPES: same data as holotype (1 ♂, ANIC; 1 ♀, 1 ♂, CAS).

Sericophorus chalybeus F. Smith

Figures 34–36.

Sericophorus chalybeus F. Smith, 1851:32, ♀. Holotype: ♀, New Holland, now Australia: no specific locality (BMNH), examined by O. Lomholdt.— F. Smith, 1856:356 (in catalog of Hymenoptera in British Museum); Froggatt, 1892:221 (in catalog of Australian Hymenoptera); Dalla Torre, 1897:578 (in catalog of world Sphecidae); Turner, 1914:348 (in revision of Australian *Sericophorus*, as *chalybaeus*), 1915b:552 (Tasmania: Eaglehawk Neck, as *chalybaeus*); Rayment, 1955a:27 (in revision of Australian *Sericophorus*, as *chalybaeus*, as stat. n.), 1955b:139 (nesting habits); Bohart and Menke, 1976:302 (listed); Cardale, 1985:246 (in catalog of Australian Sphecidae).— As *Tachyrhostus chalybeus*: Kohl, 1885:430 (new combination, in checklist of world *Tachyrrhostus*).

Tachyrrhostus cyaneus de Saussure, 1854:26, ♀. Holotype: ♀, New Holland, now Australia: no specific locality (MHNG), examined by O. Lomholdt and W. Pulawski. Synonymized with *Sericophorus chalybeus* by F. Smith, 1856:356.— As *Sericophorus cyaneus*: de Saussure, 1863:69 (new combination); W. Schulz, 1911b:183 (redescription).

Sericophorus inornatus Rayment, 1955a:34, ♀. Holotype: ♀, Australia: given as Queensland, but actually Tasmania: Wynyard (QMB), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:247 (in catalog of Australian Sphecidae).

Sericophorus lilacinus Rayment, 1955a:35, ♀. Holotype: ♀, Australia: given as Queensland, but actually Tasmania: Wynyard (QMB), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:247 (in catalog of Australian Sphecidae).

Sericophorus rufipes Rayment, 1955a:47, ♀, junior secondary homonym of *Sericophorus rufipes* (Rohwer, 1911). Holotype: ♀, Australia: Tasmania: no specific locality (SAM), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**

Sericophorus sculpturatus Rayment, 1955b:134, ♂. Holotype: ♂, Western Australia: Busselton (ANIC), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:249 (in catalog of Australian Sphecidae).

Sericophorus subviridis Rayment, 1955a:49, ♀. Holotype: ♀, Australia: Victoria: Victoria Valley (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:249 (in catalog of Australian Sphecidae).

Sericophorus sydneyi Rayment, 1955a:50, ♀. Holotype: ♀, Western Australia: Bolgart (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Rayment, 1955a:64 (nesting); Bohart and Menke, 1976:302 (listed); Cardale, 1985:250 (in catalog of Australian Sphecidae).

Sericophorus victoriensis Rayment, 1955a:52, ♀. Holotype: ♀, Australia: Victoria: Portland (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Rayment, 1955b:134 (description of ♂), 135 (nesting habits.); Bohart and Menke, 1976:302 (listed); Cardale, 1985:250 (in catalog of Australian Sphecidae).

Sericophorus raymenti Menke *in* Bohart and Menke, 1976:302. Substitute name for *Sericophorus rufipes* Rayment, 1955. **New synonym by O. Lomholdt.**— Cardale, 1985:248 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus chalybeus* is one of several species with the head, thorax, propodeum, and gaster mainly metallic green or bluish. It has a unique tergum I whose horizontal area forms an obtuse tubercle anteromesally (Fig. 34d), although the tubercle is inconspicuous in the smallest males. It also has an unusual scutellum that is markedly convex, in basal two thirds with an obtuse, longitudinal, dark swelling (Fig. 34c) that contrasts in color with the surrounding areas and whose apex is prominent. A similar scutellum is found in *glaucus* and *wheeleri*. Unlike *glaucus*, the frons of *chalybeus* is metallic green, the ocellocular distance equal to 1.3 × hindocellar width (rather than 0.8 × hindocellar width), and the lamella of the male clypeus has two lateral teeth on each side (Fig. 34b), rather than being angulate laterally. Unlike *wheeleri*, the entire frons is metallic green, the ocellocular distance equals 1.3 × hindocellar width, the setae are shorter

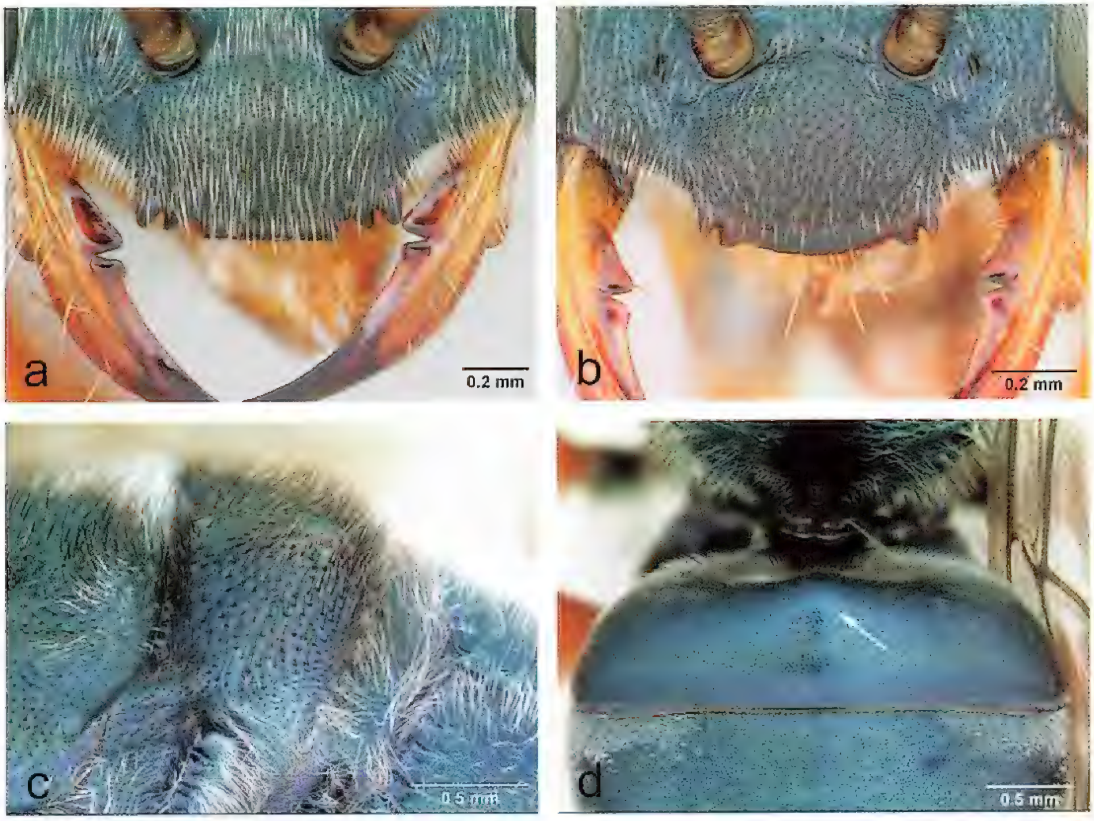

Figure 34. *Sericophorus chalybeus* F. Smith: a – female clypeus in frontal view; b – male clypeus in frontal view; c – scutellum in lateral oblique view; d – tergum I in dorsal view (arrow indicates obtuse tubercle).

(about 1.2–1.3 × midocellar width on interocellar area, about 1.0 × on hindfemoral venter), and the male flagellum (all or largely) and at least the forefemur are reddish brown. In *wheeleri*, the upper frons is black, the ocellocular distance equal to 1.8 × hindocellar width, the setae are longer (about 2.0 × midocellar width on interocellar area and 1.0 × on hindfemoral venter), and the male antenna is black and the femora are metallic green.

Description.— Frons convex mesally, markedly concave above antennal socket; frontal punctures several diameters apart; frontal line in form of elongate, unsculptured area near midheight of frons; interocellar area convex adjacent to hindocellus, concave mesally. Ocellocular distance equal to 1.3 × hindocellar width. Middle clypeal section somewhat protruding (Fig. 34a, b). Scutal and mesopleural punctures several diameters apart; admedian line and notaulus well defined, notaulus transversely carinate; scutal flange gradually narrowing posterad. Scutellum conspicuously convex, in basal two thirds with obtuse median swelling that is prominent apically (swelling dark, contrasting in color with adjacent areas). Propodeal dorsum punctate, adjacent to foremargin with deep crenulate sulcus that extends mesally into glabrous, longitudinal sulcus; longitudinal sulcus with sharp median carina anteriorly and several transverse ridges posteriorly; side conspicuously microareolate, with evanescent punctures, delimited from posterior surface by oblique ridges (but without longitudinal ridge); posterior surface either all ridged (except mesally) or partly unridged, punctate, conspicuously microareolate. Forewing vein M interstitial with cu-a; second submarginal cell markedly narrowed anteriorly, triangular in some specimens. Tergal punctures minute, about one diameter apart; anterior declivity of tergum I markedly concave, horizontal area with obtuse tubercle anteromesally (tubercle inconspicuus in smallest males).

Setae silvery, not concealing integument on frons and clypeus; erect on upper frons and postocellar area, on interocellar area about 1.2–1.3 × as long as midocellar width; erect, slightly shorter than midocellar width on scutum; erect, silvery on propodeal dorsum (median sulcus asetose).

Head, thorax, propodeum, and gaster metallic green or bluish, with following exceptions: clypeus black ventrally, with metallic luster dorsally; mandible yellow to ferruginous, apex dark ferruginous; antenna mainly light ferruginous, scape, pedicel, and tip of apical flagellomere darkened in most specimens, apical antennal segments darkened dorsally in male; pronotum laterally and pronotal lobes reddish in occasional specimens. Legs mainly ferruginous, mid- and hindfemora darkened, especially in specimens from Tasmania and southernmost Australia; tergum I with ill-defined transverse, reddish band in some specimens; apical gastral segment dark brown to black, setae of female pygidial plate pale golden to light brownish.

♀.— Orbital fovea ill defined. Dorsal length of flagellomere I 1.5 × apical width, of flagellomere II 1.3 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with six or seven rake spines. Setae of pygidial plate not concealing integument. Length 9.0–12.0 mm.

♂.— Dorsal length of flagellomere I 1.3 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with five rake spines. Sternum VIII emarginate apically (Fig. 35a). Genitalia: Fig. 35b. Length 6.5–9.0 mm.

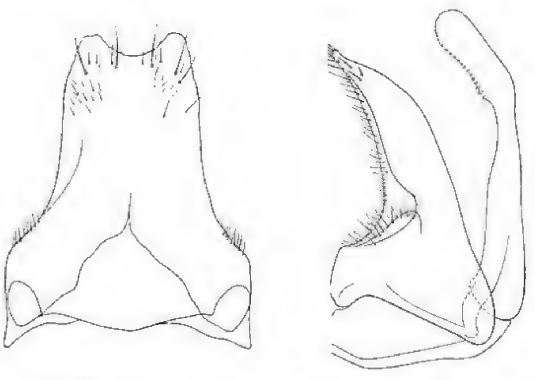

Figure 35.— *Sericophorus chalybeus* F. Smith: a – male sternum VIII; b – male genitalia in lateral view.

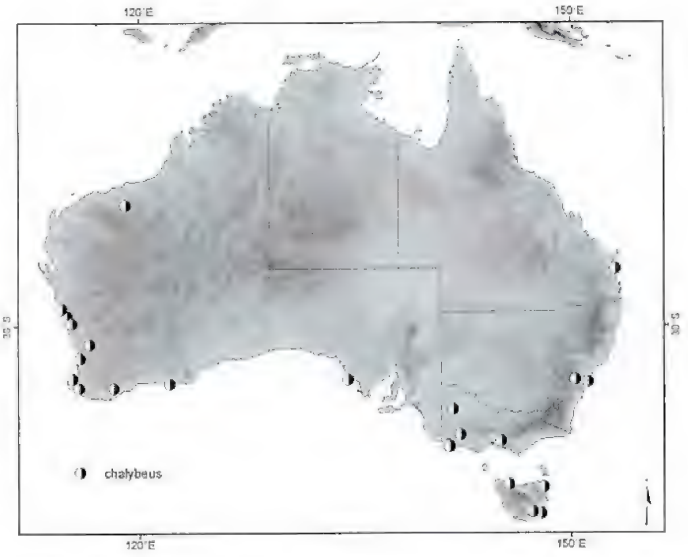

FIGURE 36. Collecting localities of *Sericophorus chalybeus*.

GEOGRAPHIC DISTRIBUTION (Fig. 36).— All Australia including Tasmania (unknown from Northern Territory).

RECORDS.— **AUSTRALIA**: **New South Wales**: Leura, Blue Mountains, 24 Jan 1903 (1 ♀, BCRI); Sydney, Dec 1903 (1 ♀, BISH). **Queensland**: Cooloola, 6 Sept 1978 (1 ♀, CAS). **South Australia**: Flinders Island, 19 Jan 1952 (1 ♀, ANIC: 1 ♀, CAS). **Tasmania**: Hobart, 4 Jan 1951 (1 ♀, ANIC); Eaglehawk Neck, 12 Feb–3 Mar 1913 (2 ♀, AMS; 4 ♀, BMNH); 19 km NNW St. Helens at 41°11′S 148°07′E, 14 Jan 1983 (1 ♀, ANIC); Wynyard, 1 Feb 1916 (2 ♀, QMB, holotypes of *inornatus* and *lilacinus)*, Feb 1924 (3 ♂, UQIC); no specific locality (2 ♀, SAM, holotype and paratype of *rufipes* Rayment). **Victoria**: Cape Nelson Road, 18 Jan 1952 and 20 Feb 1953 (2 ♀, UCD); Gorae West, 20 Jan 1953 (1 ♀, ANIC); Mount Richmond via Portland, 19 Feb 1956 (2 ♀, NMV); Noble Park, Feb 1944 (2 ♀, CU); Portland, Feb 1913 (1 ♀, NMV, holotype of *victoriensis*); Portland: Cape Nelson Road, 20 Jan, 25 Jan and 20 Feb 1945 (7 ♀, ANIC), 20 Jan 1953 (1 ♂, ANIC, incorrectly labeled "Allotype" of *victoriensis* by Rayment, not part of original description); Victoria Valley, 26 Feb 1949 (1 ♀, NMV, holotype of *subviridis*); Wyperfeld National Park, 7 and 8 Dec 1978 (2 ♀, AMS). **Western Australia**: Bolgart, 16 Apr 1950 (2 ♀, NMV, including holotype of *sydneyi* and 1 ♀ incorrectly labeled "Cotype", not part of original description); Busselton, 6 Apr 1954 (1 ♂, ANIC, holotype of *sculpturatus*); Cape Le Grand National Park, 11 Jan 1987 (1 ♀, UQIC); Donnelly River crossing on Pemberton-Nannup Road, 24 Dec 1966 (1 ♂, CAS; 1 ♂, UQIC); Dongarra, 4–10 Oct 1935 (1 ♀, BMNH); Eneabba at 29°49′S 115°16′E (2 ♂, WAMP); Esperance, 26 Nov 1979 (2 ♂, UCD); Geraldton, Oct 1910 (1 ♀, MCZ); south of Perth, 26 Apr 1964 (1 ♀, WAMP); Stirling Range Caravan Park at 34°19′S 118°12′E, 29 Mar–2 Apr 1993 (1 ♀, WAMP); Woodstock Station at 21°37′00″S 119°01′24″E, 27 Sept 1988 (1 ♀, WAMP). **Locality unknown**: 1 ♀ (BMNH, holotype of *chalybeus*); 1 ♀ (MHNG, holotype of *Tachyrrhostus cyaneus*).

Sericophorus chrysophorus Pulawski, sp. nov.

Figures 37–39

NAME DERIVATION.— *Chrysophorus*, from the Greek word *χρυσοφόρος*, wearing gold; with relation to the strikingly golden frons of most specimens.

RECOGNITION.— *Sericophorus chrysophorus* is a species with an all black head (except for the mandible and scape), thorax (except for the pronotal collar with a pair of pale yellow spots), propodeum, forecoxa, and gaster, and contrastingly reddish brown femora, tibiae, and tarsi. It differs from similar species in having a longitudinal carina that separates the propodeal dorsum from the side (Fig. 37d); carina in many specimens is absent anterad of the spiracle. The straight posterior mandibular margin (between the articulation and notch), the pale yellow pronotal collar (black mesally), and the propleuron not expanded posterolaterally differentiate *chrysophorus* from *laevigatus*. The appressed setae on the postocellar area, the punctate (not ridged) propodeal dorsum, the largely impunctate mesally apical depression of tergum II, the well-defined orbital fovea in the

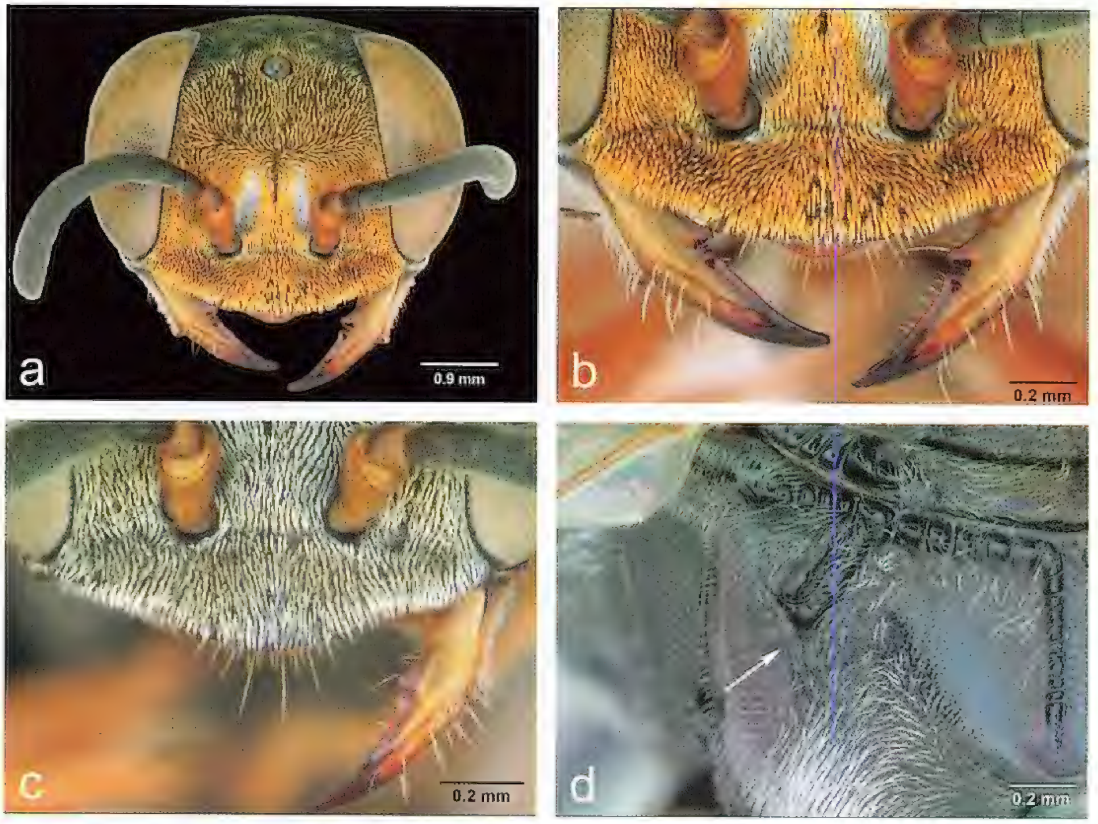

FIGURE 37. *Sericophorus chrysophorus* Pulawski, sp. nov.: a – female head in frontal view; b – female clypeus in frontal view; c – male clypeus in frontal view; d – female propodeum in dorsal oblique view (arrow indicates carina separating propodeal dorsum and side).

female, and the intensely golden setae on the frons and clypeus in many females (Fig. 37a) and some males, are subsidiary recognition features.

DESCRIPTION.— Frontal punctures minute, ill defined, averaging one diameter apart. Frontal line present for about one quarter length of frons, not extending above frons midheight. Ocellocular distance equal to about 1.2 × hindocellar width. Scutal punctures averaging about one diameter apart; scutal flange ending abruptly. Mesopleural punctures averging about one diameter apart just below scrobe, but several diameters apart more ventrally. Propodeal dorsum punctate (punctures several diameters apart posteriorly), with glabrous median sulcus that contains longitudinal carina; side unsculptured anteriorly, ridged in posterior half or so, dorsally with longitudinal carina that separates it from dorsum (carina in many specimens absent anterad of spiracle); posterior surface punctate except mesally. Forewing vein M diverging from M+Cu basad of cu-a (but only minimally so in some specimens); second submarginal cell triangular. Horizontal area of tergum I with punctures that are several diameters apart (apical depression impunctate posteriorly); apical depression of tergum II largely impunctate mesally.

Setae of frons and clypeus intensely golden in female and some males (except silvery above antennal socket), totally obscuring integument on lower frons and clypeus, but pale golden and not completely concealing integument in most males; upper frons with sparse, erect setae (in addition to appressed ones) not longer than midocellar width; postocellar area and scutum with appressed setae; propodeal dorsum with subappressed setae that are oriented anterad.

Head (including flagellum), thorax, propodeum, and gaster black except the following: mandible pale yellow, reddish brown subapically, black apically, and pronotal collar with pale yellow, interrupted band. Femora, tibiae, and tarsi reddish brown.

♀.— Orbital fovea well defined, wider than half ocellocular distance. Clypeus: Fig. 37b. Dorsal length of flagellomere I 1.2 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate not concealing integument. Length 6.2–8.1 mm.

♂.— Clypeal lamella with prominent lateral corner (Fig. 37c). Flagellomeres practically not convex ventrally; dorsal length of flagellomeres I and II 0.9 × apical width; greatest length of flagellomere IX 1.0 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with four or five rake spines. Sternum VIII protruding apicomesally (Fig. 38a). Genitalia: Fig. 38b. Length 4.6–6.0 mm.

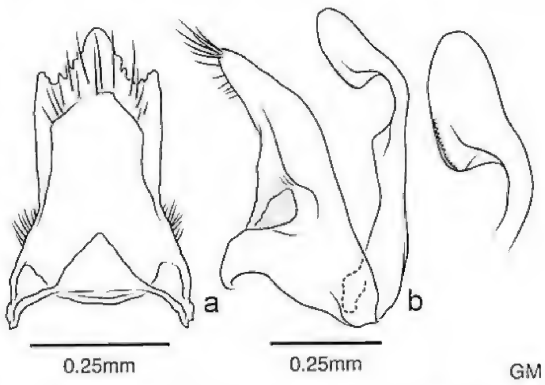

FIGURE 38. *Sericophorus chrysophorus* Pulawski, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

GEOGRAPHIC DISTRIBUTION (Fig. 39).— Western Australia.

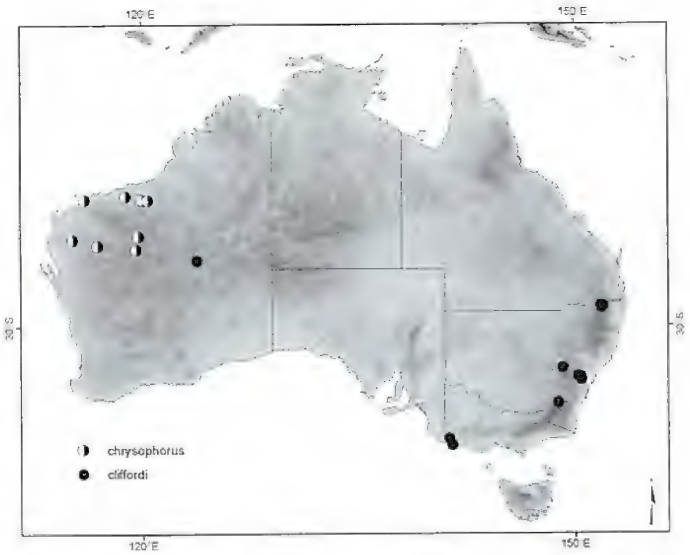

FIGURE 39. Collecting localities of *Sericophorus chrysophorus* and *cliffordi*.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Western Australia**: Mardie Station 28 km E Forescue Roadhouse at 21°11.3′S 115°58.5′E, 21–23 May 2003, F.D. Parker and M.E. Irwin (ANIC). **PARATYPES** (all collected by F.D. Parker and M.E. Irwin): **AUSTRALIA: Western Australia**: same data as holotype (1 ♀, 3 ♂, ANIC; 2 ♀, CAS; 1 ♀, USU); Kennedy Range National Park at 23°56.8′S 115°10.4′E, 26 Apr–10 May 2003 (1 ♀, 1 ♂, ANIC; 1 ♀, 1 ♂, USU); 11 km E Marble Bar at Brockman Creek at 21°09.0′S 119°51.7′E, 2–14 May 2003 (1 ♂, ANIC); 30 km E Marble Bar at Yandicoogina Creek at 21°11.0′S 120°01.7′E, 2–14 May 2003 (2 ♀, ANIC; 1 ♀, CAS; 1 ♀, USU); 68 km ♀ Marble Bar at 21°13.8′S 120°22.7′E, 2–14 May 2003 (1 ♀, ANIC); 25 km N Marble Bar at 20°56.2′ 118°51.0′E, 15 May 2003 (1 ♂, USU); Mount Augustus National Park at 24°21.7′S 116°50.2′E, 25 Apr–7 May 2003 (1 ♂, CAS), 9–22 May 2003 (1 ♀, USU), and at 24°22.8′S 116°54.2′E, 9–22 May 2003 (1 ♀, ANIC); 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003 (1 ♀, ANIC; 1 ♂, CAS), 7–18 May 2003 (3 ♀, 2 ♂, ANIC; 1 ♀, 1 ♂, CAS; 1 ♀, 1 ♂, USU), 18–21 May 2003 (1 ♂, USU); and 21–23 May 2003 (1 ♀, CAS); 45 km S Newman at 23°42.4′S 119°44.3′E, 6–18 May 2003 (1 ♀, ANIC).

***Sericophorus cliffordi* Rayment**
Figures 39–41.

Sericophorus cliffordi Rayment, 1955a:30, ♀. Holotype: ♀, Australia: Victoria: Gorae West (NMV), examined by O. Lomholdt and W. Pulawski.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:246 (in catalog of Australian Sphecidae).

Sericophorus cyanophilus Rayment, 1955a:31, ♀. Holotype: ♀, Australia: Queensland: Stanthorpe (QMB), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:247 (in catalog of Australian Sphecidae).

Sericophorus chalybaeus [sic] *fulleri* Rayment, 1955a:29, ♀. Holotype or syntypes: ♀, Australia: Australia Capital Territory: Blundells 20 mi. W Canberra (ANIC), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:246 (in catalog of Australian Sphecidae).

Sericophorus gracilis Rayment, 1955a:33, ♀. Holotype: ♀, Australia: Queensland: Glen Aplin (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:247 (in catalog of Australian Sphecidae).

Sericophorus rufotibialis Rayment, 1955a:47, ♂. Holotype: ♂, Australia: Australia Capital Territory: Blundells 20 mi. W Canberra (ANIC), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:249 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus cliffordi* is one of the species with the head, thorax, propodeum, and gaster nearly all metallic bluish or greenish, setae erect on the upper frons and postocellar area, the propodeal dorsum with a basal crenulate sulcus that extends into a deep median sulcus (Fig. 40c), and the anterior declivity of tergum I concave. Additionally, the scutellum is slightly raised mesally and the propodeal dorsum is punctate on each side of the median sulcus (Fig. 40c), also with a few oblique ridges in some specimens. It differs from similar species (*evansi*, *sabulosus*, *viridescens*) in having the ocellocular distance equal to 1.7 × hindocellar width, the femora dark brown to black (reddish brown apically), without metallic luster, and the tibiae reddish brown. In the other three species, the ocellocular distance is smaller than the midocellar width, at least the mid- and hindfemora are bluish green or with bluish luster, and the mid- and hindtibiae are dark brown to black.

Description.— Frontal punctures varying from less than one diameter apart above antennal socket to markedly (female) or slightly (male) more than one diameter apart below hindocellus; frontal line well defined, originating from shiny, oval depression, reaching anterior ocellus in some specimens. Ocellocular distance equal to 1.7 × hindocellar width. Scutal punctures about two diameters apart (less than that near margins); scutal flange widest near apex, gradually narrowing posterad. Scutellum slightly raised mesally, in most specimens with punctures sparser near center than on adjacent areas. Mesopleural punctures no more than one diameter apart below scrobe. Propodeal dorsum densely, finely punctate, in many specimens with a few oblique ridges that vary from minute to conspicuous; with deep, crenulate sulcus adjacent to foremargin, extending mesally into wide, glabrous, longitudinal sulcus; the latter widening posteriorly, delimited posteriorly by sharp carina, with one median and a few transverse carinae; side punctate and with irregular, minute ridges, delimited from posterior surface by oblique ridges that in some specimens are crossed by zigzagging, longitudinal ridge; posterior surface punctate except for median sulcus partly ridged. Forewing vein M interstitial with cu-a; second submarginal cell conspicuously narrowed anteriorly, almost triangular in some specimens. Most tergal punctures less than one diameter apart (some punctures about one diameter apart); interspaces microareolate; anterior declivity of tergum I markedly concave.

Setae silvery, not concealing integument of lower frons and clypeus; erect on upper frons and postocellar area, on interocellar area and scutum about as long as 0.8–1.0 midocellar width, erect on propodeal dorsum.

Frons, thorax, propodeum, and gaster with bluish or slightly greenish metallic luster except the following: clypeus black, mandible reddish except almost black apically; scape and pedicel dark brown to black, flagellum bright reddish brown in female (flagellomere I dark, distal two thirds of apical flagellomere brown), all black or slightly reddish ventrally in male; pronotal lobe black (with faint reddish luster in occasional specimens); female pygidial plate reddish to almost black, setae brown, male tergum VII reddish. Femora black (reddish brown apically); tibiae reddish brown; tarsi brownish, apical tarsomere reddish.

♀.— Clypeal lamella arcuate (Fig. 40a). Orbital fovea ill defined. Dorsal length of flagellomere I 1.5 × apical width, of flagellomere II 1.3 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.5 × basal width. Forebasitarsus with 6–8 rake spines. Setae of pygidial plate almost completely concealing integument. Length 9.0–11.0 mm.

♂.— Clypeal lamella straight, with lateral corner acutely angulate (Fig. 40b). Median flagellomeres slightly swollen ventrally. Dorsal length of flagellomere I 1.3 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with 5–7 rake spines. Sternum VIII emarginate apically (Fig. 41a). Genitalia: Fig. 41b. Length 6.0–8. mm.

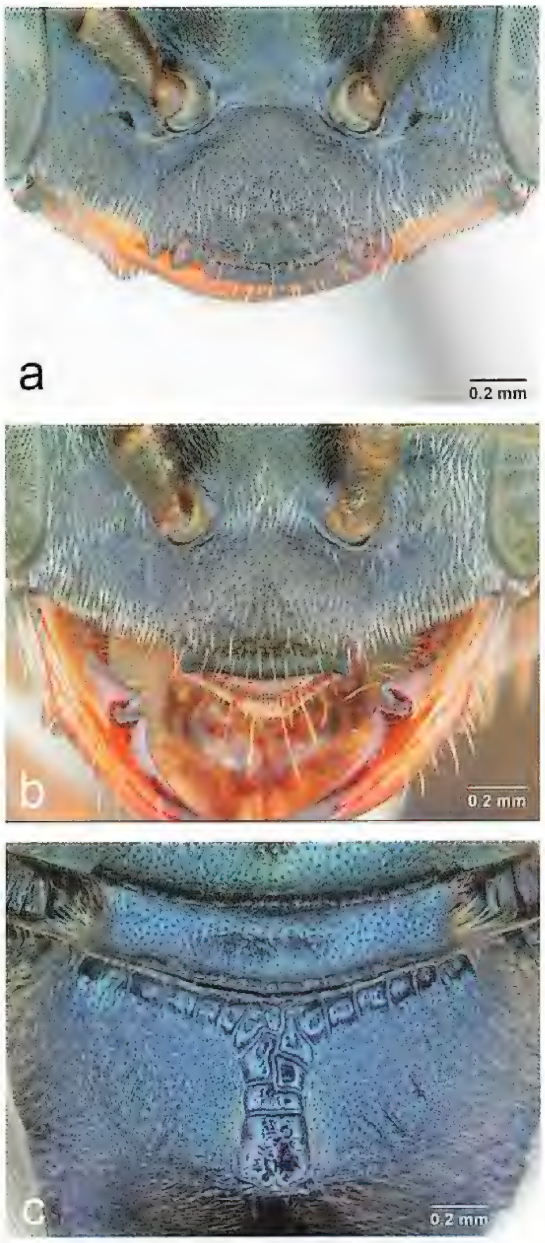

FIGURE 40. *Sericophorus cliffordi* Rayment: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female propodeum in dorsal view.

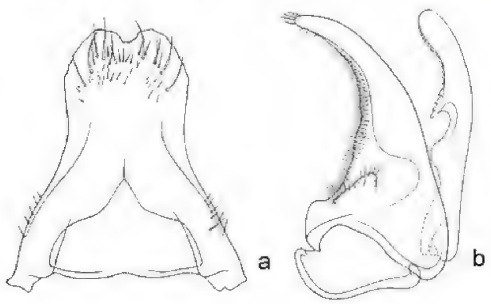

FIGURE 41 (left). *Sericophorus cliffordi* Rayment: a – male sternum VIII; b – male genitalia in lateral view.

Geographic distribution (Fig. 39).— All Australia except Northern Territory and Tasmania.

Records.— **AUSTRALIA**: **Australian Capital Territory**: Blundells 20 mi. W Canberra, 19 Jan 1936 (1 ♀, ANIC, holotype of *chalybeus fulleri*), 9 Feb 1949 (1 ♂, ANIC, holotype of *rufotibialis*; 1 ♂, ANIC, incorrectly labeled as paratype by Rayment, not part of original description), 29 Dec 1949 and 6 Jan 1961 (1 ♀, 3 ♂, ANIC). **New South Wales**: Clarence in Blue Mountains, 7 Feb 1979 (1 ♂, AMS); Flagstaff Hill in Blue Mountains, 19 Jan 1979 (1 ♂, AMS; 1 ♀, CAS); Haystack Ridge, 2 Dec 1973 (2 ♀, AMS); Mount Banks in Blue Mountains, 26 Nov 1980 (1 ♀, 1 ♂, AMS); Mount Tomah, 22 Dec 1935 (1 ♂, ANIC); 3 km S Mount Wilson, 12 Jan 1979 (1 ♂, AMS); Woodford, 19 Jan 1909 (1 ♀, BMNH); no specific locality or date (1 ♀, USNM). **Queensland**: Amiens, 4 Nov 1951 (1 ♀, 1 ♂, UQIC); Glen Alpin, 11 Dec 1945 (1 ♀, NMV, holotype of *gracilis*); Stanthorpe, 4 Nov 1914 (1 ♀, QMB, holotype of *cyanophilus*) and Dec (2 ♀, AEI), 10 Nov 1923 (1 ♂, UQIC, as St. Anthorpe); 2 km E Stanthorpe, 26 Nov 1976, on *Leptospermum attenuatum* (1 ♀, 1 ♂, UQIC). **Victoria**: ca 15 km N Dartmoor, 3 Dec 1983 (1 ♀, WAMP); Gorae West, 17 Dec 1950 (1 ♂, NMV, incorrectly labeled by Rayment as paratype, not part of original description), 16 Jan 1951 (1 ♀, 1 ♂, NMV, holotype and paratype of *cliffordi*, ♂ labeled "Allotype" by Rayment, additional 1 ♀, 3 ♂, incorrectly labeled by Rayment as paratypes, not part of original description), 23 Feb 1953 (1 ♀, ANIC), 9 Jan 1952 (1 ♂, NMV, incorrectly labeled "*S. chalybeus*, allotype" by Rayment, not part of original description). **Western Australia**: 8 km E Mt. Nossiter at 25°25′S 123°47′E, 7 August 1983 (1 ♀, WAMP).

Sericophorus clypeatus (Rayment)

Figures 42–44.

Anacrucis clypeata Rayment, 1955a:58, ♀. Holotype: ♀, Australia: Victoria: South Yarra in Melbourne (NMV), examined by O. Lomholdt and W. Pulawski.— As *Sericophorus clypeatus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:251 (in catalog of Australian Sphecidae).

Recognition.— The female of *clypeatus* has an unusual, distinctive clypeus that is deeply, broadly emarginate, with the edges of emargination markedly diverging ventrad (Fig. 42a, b). Also distinctive is the wide, tooth-like process of sternum I. Subsidiary recognition features are: frons concave above each antennal socket, with median swelling above concavities; frontal setae silvery.

The male can be recognized by the following combination: setae appressed on upper frons and postocellar area; thorax, propodeum, and gaster black except pronotal collar has a pair of pale yellow spots and the pronotal lobe is pale yellow; forecoxal venter pale yellow; posterior propodeal surface finely ridged (punctate laterally); forewing vein M interstitial with cu-a. *Sericophorus doddi* is similar, but unlike that species the antenna of *clypeatus* is black, the pronotal collar has a pair of pale yellow spots, the femora, tibiae, and tarsi are reddish brown, the ocellocular distance equals 1.0–1.1 × hindocellar width, the clypeus has a triangular, glabrous area adjacent to the lamella (the glabrous area at an angle to the lamella in profile), and the body length is 6.5–7.7 mm. In *doddi*, the flagellum is light yellowish brown, the pronotal collar is black, the femora, tibiae and tarsi are yellow, the ocellocular distance equals 0.5 × hindocellar width, the clypeus has a narrow glabrous area adjacent to the lamella (both areas are in same plane in profile), and the body length is 3.9–5.1 mm.

Description.— Frons concave above each antennal socket, with median swelling above concavities. Frontal punctures less than one diameter apart. Frontal line intersecting median swelling. Ocellocular distance equal to 1.0–1.1 × hindocellar width. Postocellar area slightly convex adjacent to hindocellus, concave mesally. Clypeus: see below. Propleuron expanded posterolaterally. Scutal punctures well defined, averaging about one diameter apart at center; interspaces slightly microsculptured except unsculptured at center; scutal flange ending abruptly. Mesopleural punctures well defined, about one diameter apart at center; interspaces unsculptured. Propodeal dorsum

finely, obliquely, sinuously ridged, punctate between ridges, basally with short, conspicuous ridges, mesally with shallow, glabrous depression that contains longitudinal carina and transverse ridges; side minutely ridged, punctate between ridges, with several larger ridges anterodorsally (beneath spiracle); posterior surface ridged except for median sulcus, punctate laterally. Forewing vein M interstitial with M+Cu; second submarginal cell triangular in most specimens, narrowly open anteriorly in holotype. Tergum I concave anteriorly, punctures of horizontal area well defined, averaging about one diameter apart; apical depressions of terga I and II punctate. Sternum I in female extended into prominent, sharp spine, posterolateral corner spinose; in male each posterolateral area toothlike (tooth pointing anterad).

Setae of lower frons and clypeus silvery, obscuring integument; appressed on upper frons, postocellar area, and scutum; appressed, oriented obliquely anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following are pale yellow: clypeus (yellowish reddish in some females, black basally in male), female labrum (reddish brown is some specimens), mandible (dark brown apically), pair of spots on pronotal collar, and pronotal lobe; apical gastral tergum reddish brown apically. Forecoxal venter pale yellow; femora, tibiae, and tarsi reddish brown except male forefemur largely black (reddish brown only dorsally).

♀.— Orbital fovea well defined, wider than half ocellocular distance. Clypeus broadly

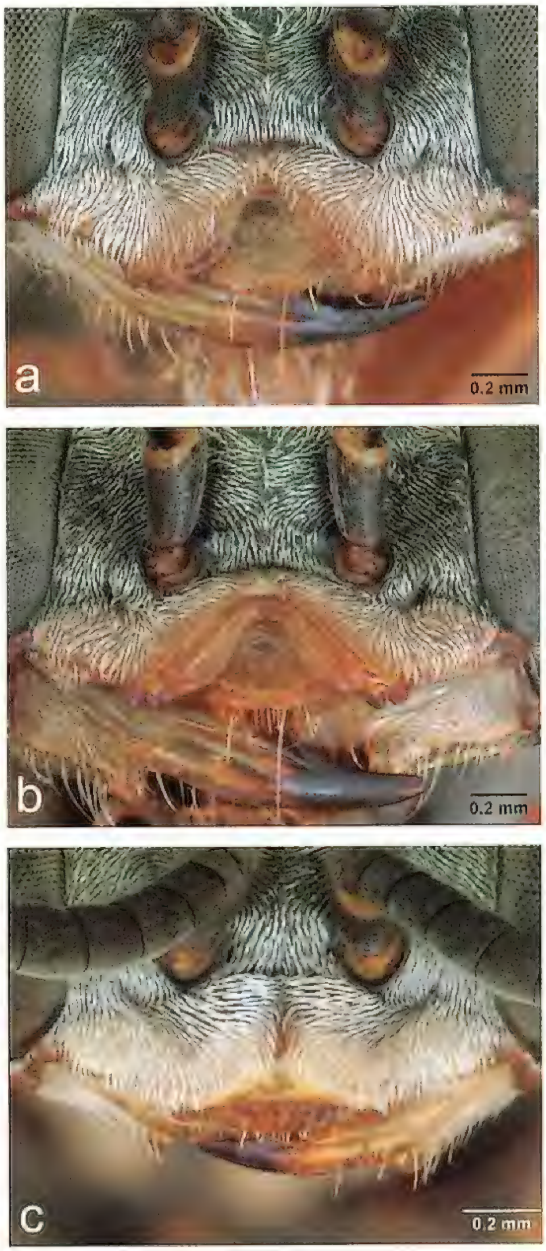

FIGURE 42. *Sericophorus clypeatus* (Rayment): a – female clypeus in frontal view; b – female clypeus in oblique ventral view; c – male clypeus in frontal view.

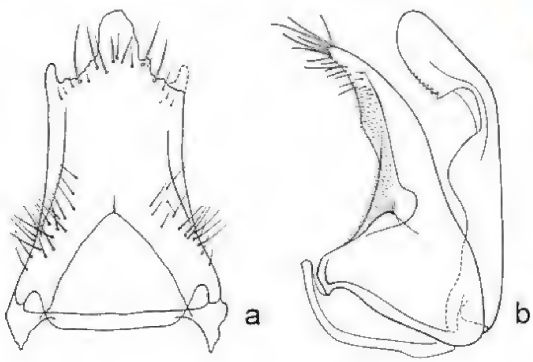

FIGURE 43. *Sericophorus clypeatus* (Rayment): a – male sternum VIII; b – male genitalia in lateral view.

emarginate mesally on about 0.8 of its length, emargination with dorsal (upper) and ventral (lower) edges; area between edges concave, glabrous; dorsal edge of emargination protruding, curved ventrally (Fig. 42a, b). Dorsal length of flagellomere I 1.6 × apical width, of flagellomere II 1.5 × apical width; greatest length of flagellomere IX 1.1 × apical width, of flagellomere X 2.0 × basal width. Forebasitarsus with five rake spines. Setae of pygidial plate not concealing integument. Length 8.3–9.0 mm.

♂.— Clypeus slightly elevated mesally, ventrally with glabrous, triangular area just above lamella; lateral corner of lamella angulate (Fig. 42c). Dorsal length of flagellomere I 1.2 × apical width, of flagellomere II 1.1 × apical width; greatest length of flagellomere IX 1.0 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with five rake spines. Sternum VIII: Fig. 43a. Genitalia: Fig. 43b. Length 6.5–7.7 mm.

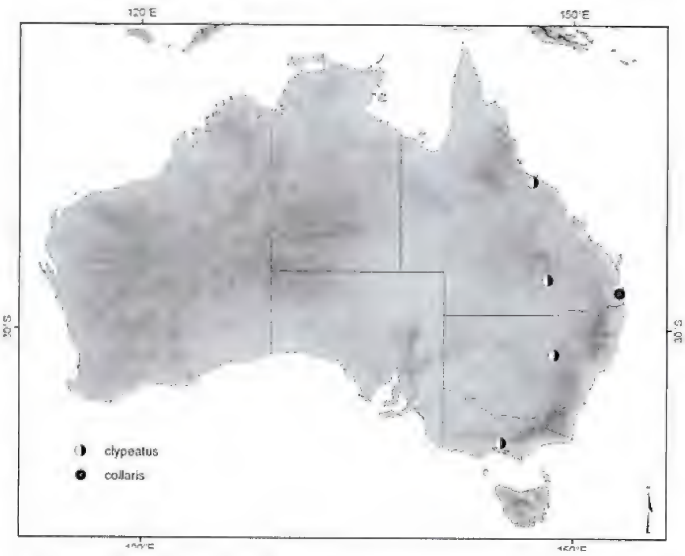

FIGURE 44. Collecting localities of *Sericophorus clypeatus* and *collaris*.

GEOGRAPHIC DISTRIBUTION (Fig. 44).— Known from two localities in Queensland, one in New South Wales, and one in Victoria.

RECORDS.— AUSTRALIA: **New South Wales**: Gilgandra, 28 Nov 1978 (1 ♀, AMS). **Queensland**: Amby, 22–27 Nov 1979 (2 ♂, UQIC); 35 km SW Ayr, 6 Oct 1950 (1 ♂, ANIC). **Victoria**: South Yarra (part of Melbourne), Jan 1950 (2 ♀, NMV, including holotype of *Anacrucis clypeata*; the other specimen is incorrectly labeled as paratype, not part of the original description).

Sericophorus collaris (Hacker and Cockerell)

Figures 44, 45.

Zoyphium collare Hacker and Cockerell, 1922:287, ♀. Holotype: ♀, Australia: Queensland: Brisbane: Birkdale (QMB), examined by O. Lomholdt and W. Pulawski.— As *Sericophorus collaris*: Bohart and Menke, 1976:302 (new combination, listed); Cardale, 1985:251 (in catalog of Australian Sphecidae).

RECOGNITION.— *Sericophorus collaris* can be recognized by its coloration: clypeus pale yellow, thorax and propodeum black except pronotal collar pale yellow (minimally reddish brown anteriorly) and scutellum and metanotum reddish brown (Fig. 45a), gaster largely reddish brown. Subsidiary recognition characters are: propodeal dorsum with median carina, slightly concave on each side of carina; propodeal side not delimited from posterior surface by longitudinal carina or oblique ridges.

DESCRIPTION (based on holotype only).— Frontal punctures less than one diameter apart; interspaces slightly shiny; frontal line shiny. Ocellocular distance equal to 0.6 × hindocellar width. Scutal punctures less than one diameter apart; interspaces slightly shiny; scutal flange gradually narrowing posterad at apex. Mesopleural punctures larger than those on scutum, about one diameter apart at center; interspaces unsculptured, shiny. Propodeal dorsum forming an almost right

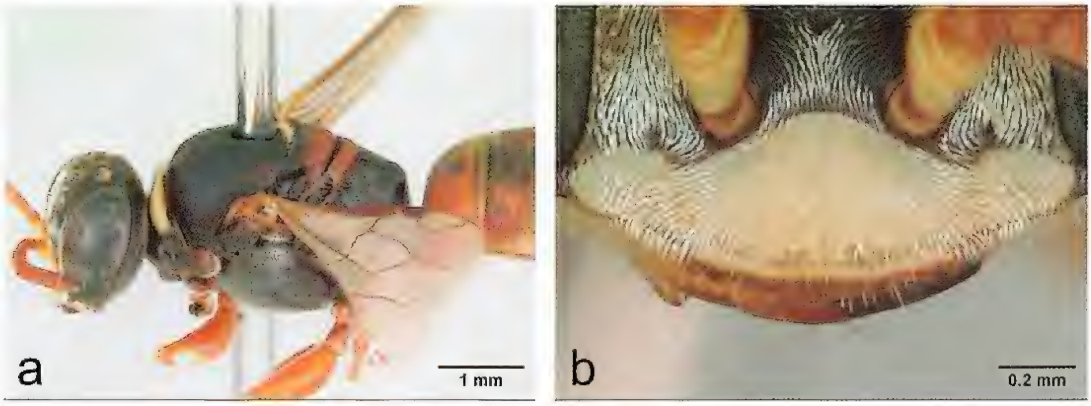

FIGURE 45. *Sericophorus collaris* (Hacker and Cockerell): a – anterior portion of female body in dorsolateral view; b – female clypeus.

angle with posterior surface; dorsum punctate (interspaces shiny), unsculptured apicomesally, adjacent to foremargin with crenulate sulcus that extends mesally into glabrous, longitudinal impression, impression with well-defined median carina; side unsculptured anteriorly, punctate posteriorly; posterior surface punctate except for median sulcus. Forewing vein M diverging from M+Cu basad of, but close to, cu-a; second submarginal cell triangular. Horizontal area of tergum I with punctures that are about one diameter apart.

Setae silvery on frons, obscuring integument on its ventrolateral portion; appressed on upper frons, postocellar area, and scutum; oriented anterad on propodeal dorsum (median impression and large apicomedian area glabrous).

Head, thorax, and propodeum black except as follows: clypeus yellow (reddish along clypeal lamella); mandible yellow basally, dark brown apically; scape yellow, pedicel and flagellum reddish brown (apical flagellomere slightly darkened); pronotal collar yellow (minimally reddish brown anteriorly), pronotal lobe with reddish tinge; scutellum and metanotum reddish brown. Legs reddish brown, forecoxa pale yellow apically, forefemur with large pale yellow spot apicoventrally. Gaster reddish brown, terga I-III with irregular dark spots.

♀.— Orbital fovea depressed, dull, elongate, its width less than half ocellocular distance. Clypeal lamella arcuate (Fig. 45b). Dorsal length of flagellomere I equal to apical width, of flagellomere II equal to 0.9 × apical width; greatest length of flagellomere IX equal to 0.8 of apical width, of flagellomere X 1.5 × basal width. Forebasitarsus with seven rake spines. Length 8.5 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 44).— Known only from Brisbane area, Queensland.

RECORDS.— AUSTRALIA: Queensland: Brisbane: Birkdale, 17 Feb 1914 (1 ♀, QMB, holotype of *Zoyphium collare*).

Sericophorus confusus Lomholdt, sp. nov.

Figures 46–48.

DERIVATION OF NAME.— *Confusus*, past participle of the Latin verb *confundo* = to mix up, to confuse, here used as an adjective.

RECOGNITION.— Closely similar to *affinis*. See that species for differences (p. 30).

DESCRIPTION.— Frontal punctures minute, less than one diameter apart; frontal line ill defined or absent. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.0 × hindocellar width. Clypeus adjacent to lamella with narrow impunc-

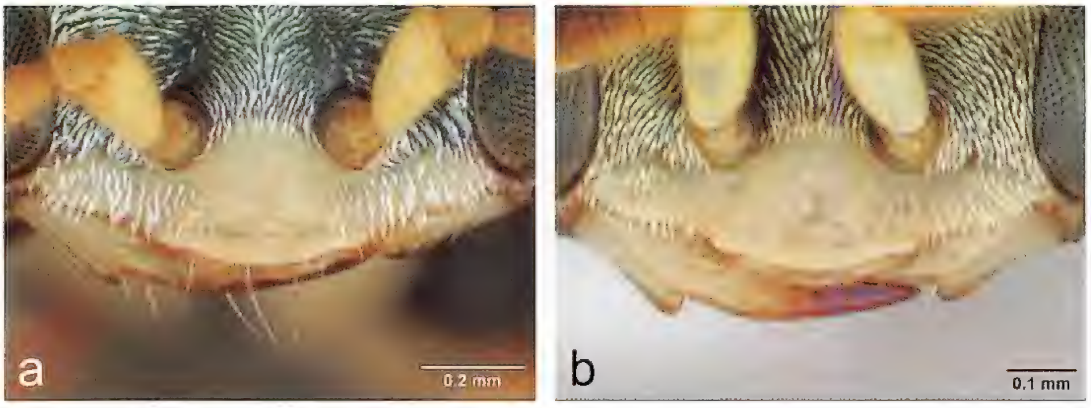

FIGURE 46. *Sericophorus confusus* Lomholdt, sp. nov.: a – female clypeus; b – male clypeus.

tate, glabrous area (Fig. 46a, b). Scutal punctures at center about one diameter apart, interspaces somewhat shiny; scutal flange widest apically, ending abruptly. Mesopleural punctures about one diameter apart beneath scrobe, interspaces unsculptured to slightly sculptured. Propodeal dorsum with ridges that are conspicuous anteriorly and minute posteriorly (most ridges reaching posterior margin), with sharp median carina, interspaces punctured; side shiny, evenly microsculptured; posterior surface microsculptured, dull except for median sulcus. Forewing vein M diverging from M+Cu basad of, but close to, cu-a; second submarginal cell conspicuously narrowed anteriorly or triangular. Terga finely punctate, interspaces slightly microsculptured, shiny, punctures several diameters apart on horizontal portion of tergum I; apical depressions impunctate.

Setae of lower frons and clypeus silvery, with golden tinge in male, largely concealing integument laterally; appressed on upper frons, postocellar area, and scutum; inconspicuous, appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following: clypeus, scape, pedicel, and mandible pale yellow (mandible dark brown apically), flagellum reddish brown, darkened dorsally. Legs yellow to reddish brown, venters of forecoxa, of foretrochanter, and of forefemur basally pale yellow.

♀.— Clypeal lamella with inconspicuous lateral teeth (Fig. 46a). Orbital fovea ill defined, about as wide as half ocellocular distance. Dorsal length of flagellomere I equal to apical width, of flagellomere II equal to 0.9 × apical width; greatest length of flagellomere IX equal to 0.9 of apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate largely concealing integument. Length 4.5–5.0 mm.

♂.— Clypeal lamella with inconspicuous lateral teeth (Fig. 46b). Dorsal length of flagellomere I equal to apical width; that of flagellomere II to 0.7 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with five rake spines. Sternum VIII: Fig. 47a. Genitalia: Fig. 47b. Length 4.1–4.3 mm.

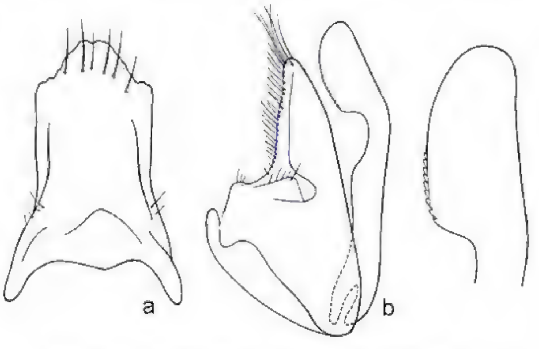

FIGURE 47. *Sericophorus confusus* Lomholdt, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

GEOGRAPHIC DISTRIBUTION (Fig. 48).— Queensland.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Queensland:** Kuranda, F.P. Dodd, 1916–27 (BMNH). PARATYPES: **AUSTRALIA: Queensland:** same data as holotype (3 ♀, 3 ♂, BMNH; 1 ♀, 1 ♂, CAS); Bamaga, 18 Feb 1984, J. Sedlaček (1 ♂, AIE); Cairns district, F.P. Dodd (1 ♀, 1 ♂, BMNH; 1 ♀, 1 ♂, SAM); Kuranda, 17–24 Feb 1984, L. Masner (1 ♂, CAS); Kuranda: Russett Park, 20 and 22 Oct 1987, T.W. Davies (2 ♂, CAS); Redlynch, 26 Sept 1938, Papuan Australian Expedition (1 ♂, BMNH).

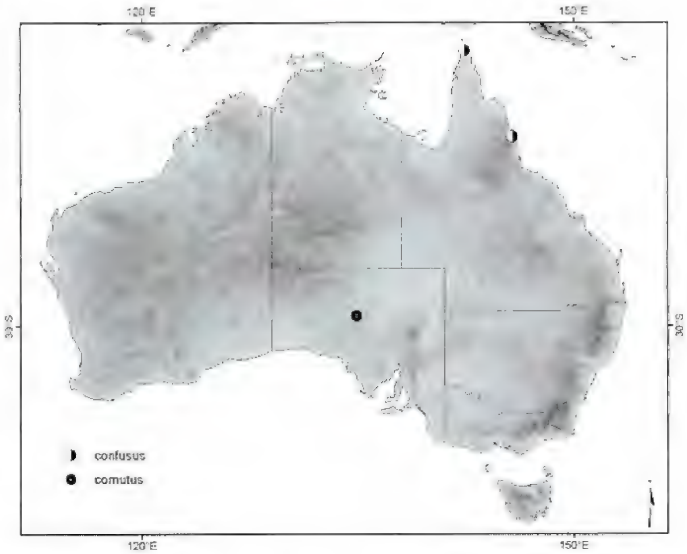

FIGURE 48. Collecting localities of *Sericophorus confusus* and *cornutus* (the location of *cornutus* is only approximate as the specific locality was not indicated in the original description).

***Sericophorus cornutus* Lomholdt, sp. nov.**
Figures 48, 49.

NAME DERIVATION.— *Cornutus*, Latin for horned; with reference to the clypeal prominence of this species.

RECOGNITION.— *Sericophorus cornutus* has the clypeus with an elevation that is concave, glabrous ventrally and culminates in a conspicuous projection (Fig. 49b, c); the spiracle of tergum I is slightly prominent (forming an angle with the tergum surface), similar to that of *nasicornis* and markedly smaller than in *rhinoceros* and *sericeus*. *S. cornutus* differs from these three species in having the apical depression of tergum I densely setose (integument almost totally concealed, rather than not concealed) and by its color pattern: the pronotal collar and the metanotum are pale yellow, whereas the scutellum is reddish brown (Fig. 49a).

DESCRIPTION (based on holotype only).— Frontal punctures minute, less than one diameter apart; frontal line inconspicuous. Ocellocular distance equal to 0.9 × ocellocular distance. Middle clypeal section elevated, ventral portion of elevation triangular, concave, glabrous; dorsal portion compressed into flat, tooth-like projection (projection shorter than scape); free margin of clypeal lamella straight (Fig. 49b, c). Propleuron conspicuously prominent posterolaterally. Scutal punctures about 1–2 diameters apart mesally; scutal flange ending abruptly. Mesopleural punctures about two diameters apart near center; interspaces unsculptured, shiny. Propodeal dorsum punctate, with short longitudinal ridges adjacent to foremargin, with median, longitudinal impression and median carina; side unsculptured anteriorly, then minutely ridged, finely punctate in apical half; posterior surface punctate except for median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly. Tergum I with spiracle slightly prominent apically (forming an angle with tergum surface); basolateral carina ending behind anterior margin of spiracle; horizontal portion of tergum I and following terga with punctures that are less than one diameter apart. Sternum I basally with elevation that ends as oblique lamella at about sternal midlength.

Setae silvery, concealing integument on lower frons and on clypeus laterally; appressed on

upper frons, postocellar area, and scutum; subappressed, oriented anterad on propodeal dorsum; almost completely obscuring integument on apical depressions of terga I-III.

Head black except the following: clypeus, scape, and mandibular base yellow (clypeus brown adjacent to lamella, mandibular apex dark brown), pedicel and first two flagellomeres reddish brown, remaining flagellomeres brown, reddish brown ventrally. Pronotum largely reddish brown, partly black, collar and lobe pale yellow. Mesothorax black except scutellum reddish brown, metanotum yellow, and propodeum black (reddish brown between side and posterior surface). Legs reddish brown, fore- and midfemora yellow apicoventrally. Gaster largely black, segment I reddish brown (tergum I black posterolaterally); apical depressions of terga I-V translucent; narrow transverse bands anterad of apical depressions on terga II-V reddish brown.

♀.— Orbital fovea wider than half ocellocular distance. Dorsal length of flagellomere I 1.1 × apical width; of flagellomere II 1.2 × apical width; greatest length of flagellomere IX equal to 0.8 of apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with eight rake spines. Setae of pygidial plate completely concealing integument. Length 10.5 mm.

♂.— Unknown.

Geographic distribution (Fig. 48).— Southern Australia.

Records.— Holotype: ♀, **AUSTRALIA: Southern Australia**: no specific locality or date, no 1123, A.P. Burgess, determined as *Zophium sericeum* Kohl by R.E. Turner (SAM).

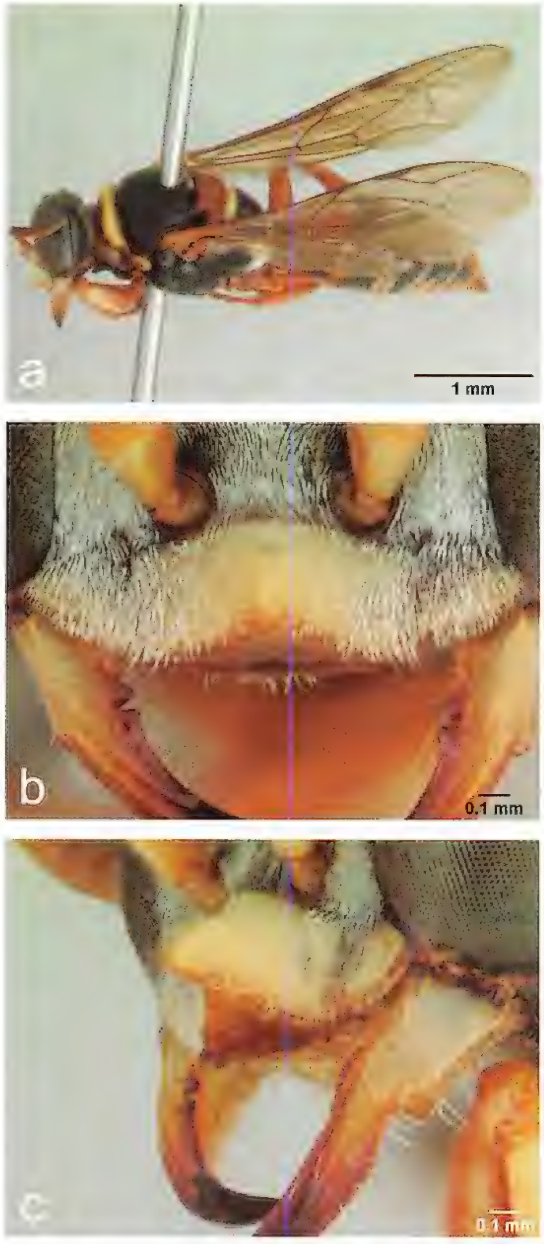

Figure 49. *Sericophorus cornutus* Lomholdt, sp. nov.: a – female body; b – female clypeus in frontal view; c – female clypeus in lateral oblique view.

Sericophorus crassicornis (Cockerell)

Figures 50–52.

Zoyphium crassicorne Cockerell, 1914:271, ♂. Holotype: ♂, Australia: Queensland: Brisbane (QMB), examined by O. Lomholdt and W. Pulawski.— Turner, 1914:358 (in revision of Australian *Zoyphium*); Hacker and Cockerell, 1922:285 (description of ♀).— As *Sericophorus crassicornis*: Bohart and Menke, 1976:302 (new combination, listed); Cardale, 1985:251 (in catalog of Australian Spheciidae).

Recognition.— *Sericophorus crassicornis* is a small species (body length 4.0–6.0 mm), with body setae appressed and an all black thorax, propodeum, and gaster (except pronotal lobe reddish

apically). Additionally, the legs are contrastingly yellow to yellowish red (including all coxae), the female clypeus is black (except reddish along clypeal lamella), and in the male the clypeal lamella has no lateral teeth (Fig. 50b) and sterna II-VI have conspicuous, erect setae. Subsidiary recognition features are: forewing vein M diverging from M+Cu basad of, but close to, cu-a, propodeum unspecialized (no lateral carinae on dorsum, no transverse or longitudinal ridges between side and posterior surface), and apical depressions of terga impunctate. *Sericophorus kohlii* is similar, but in *crassicornis* the setae completely conceal the integument of the lower frons and of the clypeus (the integument is easily visible in *kohlii*).

Description.— Frontal punctures minute, less than one diameter apart; frontal line short, ill defined. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.6–0.7 × hindocellar width in female, 0.5 × in male. Scutal punctures less than one diameter apart; scutal flange widest apically, ending abruptly. Mesopleural punctures less than one diameter apart, interspaces slightly shiny. Propodeal dorsum punctate, with short ridges along anterior margin, in many specimens with fine oblique ridges that extend to dorsum hindmargin, with sharp median carina in shallow, longitudinal depression; side finely ridged, minutely punctate between ridges, unsculptured anteriorly; posterior surface finely ridged except for median sulcus, minutely punctate between ridges. Forewing vein M diverging from M+Cu basad of, but close to, cu-a; second submarginal cell triangular or nearly so. Terga with well-defined punctures, interspaces slightly microsculptured, shiny; apical depressions impunctate, punctures several diameters apart on horizontal portion of tergum I.

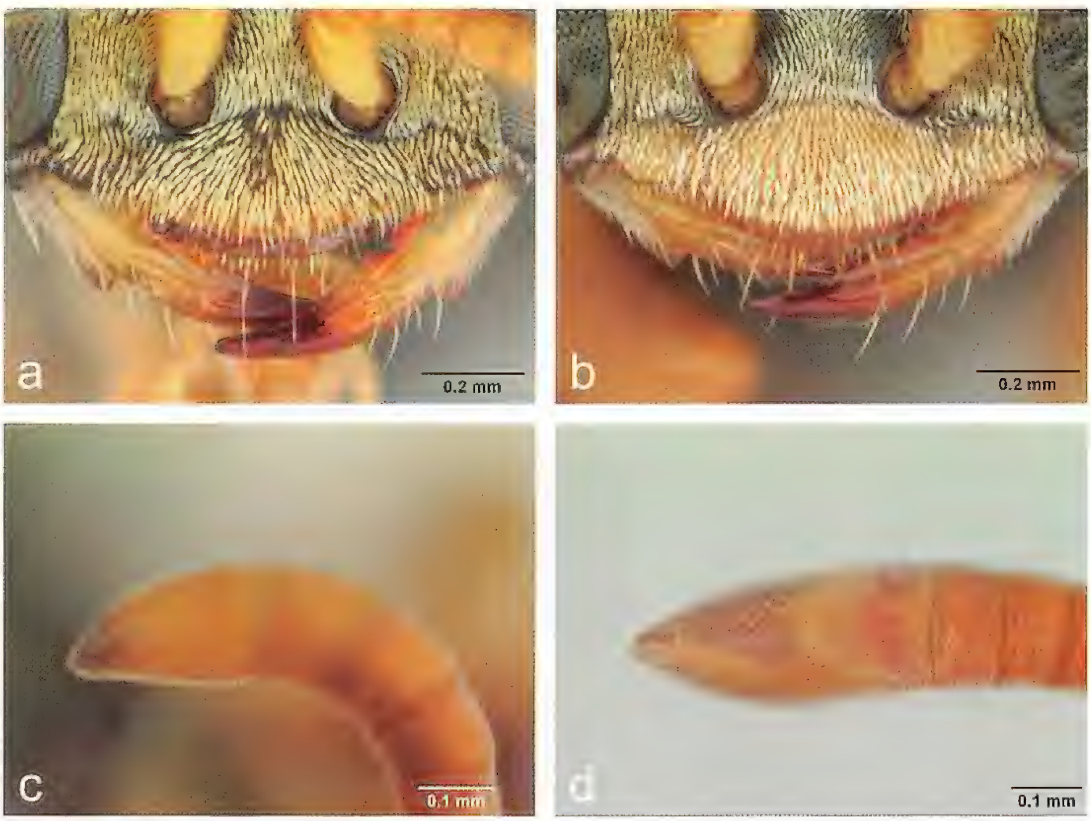

Figure 50. *Sericophorus crassicornis* (Cockerell): a – female clypeus; b – male clypeus; c – apex of female flagellum; d – apex of male flagellum.

Setae of lower frons and clypeus brassy golden except pale golden in some males, concealing integument; appressed on upper frons, postocellar area, and scutum; on propodeal dorsum inconspicuous, appressed, oriented anterad (integument glabrous apicomesally).

Clypeus black in female (narrowly reddish along clypeal lamella), yellow in male (reddish in specimen from northern Queensland). Mandible yellow basally, dark brown apically. Scape yellow, flagellum bright yellowish brown, darkened dorsally. Thorax and propodeum black except pronotal lobe reddish apically. Legs including coxae yellow to yellowish red. Gaster black.

♀.— Orbital fovea ill-defined, almost reaching hindocellus. Antenna clavate (Fig. 50c). Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X 1.7 × basal width. Forebasitarsus with 5–7 rake spines. Setae of pygidial plate not concealing integument except apically. Length 5.0–6.0 mm.

♂.— Clypeal lamella rounded laterally, without tooth (Fig. 50b). Antenna clavate (Fig. 50d). Dorsal length of flagellomere I 0.9 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 2.1 × basal width. Forebasitarsus with 4–6 rake spines. Sternum VIII: Fig. 51a. Genitalia: Fig. 51b. Length 4.0–4.7 mm.

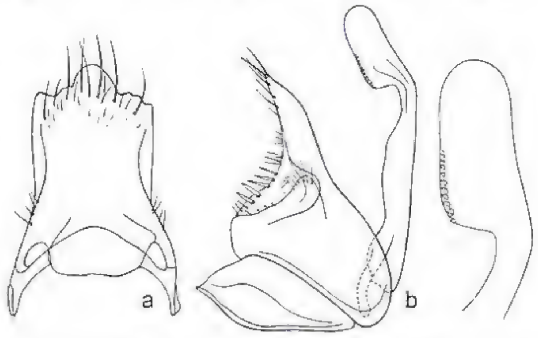

FIGURE 51. *Sericophorus crassicornis* (Cockerell): a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

GEOGRAPHIC DISTRIBUTION (Fig. 52).— New South Wales and Queensland.

RECORDS.— AUSTRALIA: New South Wales: Bilpin in Blue Mountains, 5 Apr, 20 Apr and 30 Apr 1982 (3 ♀, AMS); 6 km NE Bilpin in Blue Mountains, 20 Apr 1982 (1 ♀, CAS); 7 km NE Bilpin near Kurrajong, 27 Nov 1979 (1 ♂, AMS) and 10 Mar, 17 Mar and 8 Apr 1981 (7 ♀, 2 ♂, AMS; 2 ♀, CAS); 0.5 km SE Landsowne, 22–30 Nov 1992 (1 ♀, ANIC); Nadgee Reserve 4.7 km S Merrica Hut, 21 Dec 1985 (1 ♀, 1 ♂, UCD); Nadgee Reserve S Newtons Beach, 19 Dec 1985 (1 ♂, UCD); Warrumbungle National Park: Brownes Creek at 31°16′S 148°58′E, 12–16 Dec 1995 (1 ♀, UCD). **Queensland**: Beerwah, 30 Mar 1961 and 30 Oct 1966 (3 ♀, 1 ♂, UQIC); Brisbane, 21 Apr 1914 (1 ♀, 1 ♂, QMB, incorrectly labeled "Type series", not part of original description); 16 Mar 1915, 8 Feb 1916, 15 Feb 1916, 20 Sept 1916, 3 Oct 1916, 7 Mar 1918 (2 ♂, BMNH; 2 ♂ CAS; 1 ♀, USNM; 6 ♀, 11 ♂, UQB), and 13 Apr 1960 (1 ♀, UQIC); Brisbane: Sunnybank, 13 May 1912, on flowers of *Lomatia* (1 ♂, QMB, holotype of *Zoyphium crassicorne*); Calamvale near Brisbane, 5 Oct 1975, on *Melaleuca* (1 ♂, UQIC); Caloundra, 20 Jan

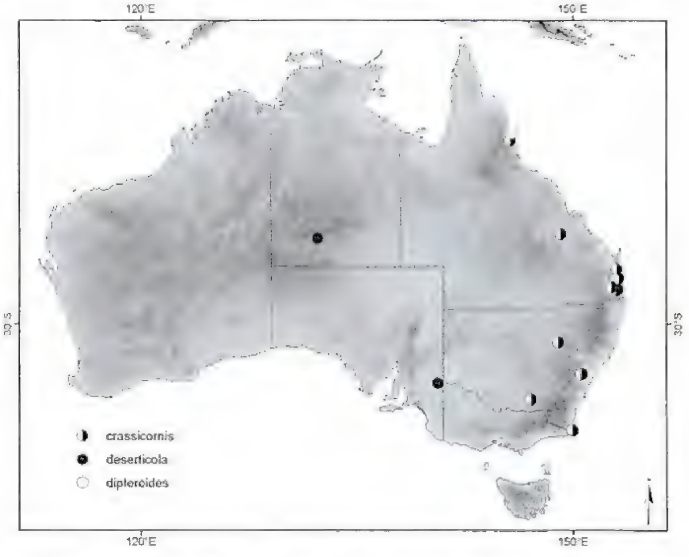

FIGURE 52. Collecting localities of *Sericophorus crassicornis*, *deserticola*, and *dipteroides*.

1916 (1 ♀, BMNH) and Darra, 14 Oct 1913 (1 ♀, QMB), incorrectly labeled as paratypes, not part of original description); Cooloola National Park, 7 Mar 1984 (1 ♀, AEI); 8 mi. from Fernvale, 19 Dec 1966 (1 ♂, UQIC); 2 km south of Horseshoe Lookout, Blackdown Tab. at 23°46′S 149°06′E, 23–24 Apr 1981 (1 ♀, ANIC); Lake Eacham at 17°17′S 145°37′E, 29 Mar–31 May 1988 (1 ♀, ANIC); North Queensland: no specific locality, R.C.L. Perkins coll. (1 ♂, BMNH); 9 km ENE Mount Tozer at 12°43′S 143°17′E, 5–10 July 1986 (1 ♀, ANIC).

***Sericophorus deserticola* Pulawski, sp. nov.**
Figures 52, 53.

Name derivation.— *Deserticola*, Latin for desert dweller; a noun in apposition to the generic name; with reference to this species habitat.

Recognition.— Like *tibialis*, *deserticola* has a markedly enlarged hindtibia (Fig. 53e), thicker than the hindfemur (although slightly less than in that species). Unlike *tibialis*, the clypeal lamella is nonprominent, broad (distance between lateral teeth minimally greater than the interantennal distance, rather than markedly smaller), and the foretarsal rake is elongate (longest spine of forebasitarsus equal to 1.8 × basitarsus width, rather than equal to basitarsus width). Subsidiary recognition features are: ocellocular distance unusually large, equal to 1.5 × hindocellar width, orbital fovea well defined, antennal socket separated from clypeal free margin by slightly more than socket width, and the pygidial plate in some but not all females is sparsely punctate (many punctures at center about two diameters apart, rather than less than one diameter apart).

Description.— Head wide (Fig. 53a), length to width ratio about 1.0:1.2 (length measured from midpoint of clypeal free margin to top of vertex). Frons markedly convex (Fig. 53b). Frontal punctures minute, about one diameter apart. Frontal line short, present only near frons midheight. Antennal socket separated from clypeal free margin by slightly more than socket width. Ocellocular distance equal to 1.5 × hindocellar width. Pronotal collar not reaching level of scutum. Scutal punctures 2–3 diameters apart; interspaces microscopically reticulate, somewhat shiny; scutal flange sharply narrowing posteriorly. Mesopleuron finely reticulate, with ill-defined punctures. Propodeal dorsum rugose; side ridged; posterior surface ridged except for median sulcus, largely unsculptured in one paratype from South Australia. Forewing vein M diverging from M+Cu slightly distad of cu-a; second submarginal cell narrowly open anteriorly. Hindtibia thickened, thicker than hindfemur (Fig. 53e), although less so than in *tibialis*, flattened laterally. Horizontal area of tergum I with punctures that average 2–3 diameters apart; apical depressions of terga I and II impunctate.

Setae of lower frons and clypeus silvery or golden, not obscuring integument; appressed in specimens from South Australia; in that from Northern Territory erect but short on upper frons and postocellar area, on interocellar area about as long as 0.4 × midocellar width, on scutum suberect, 0.4 × as long as midocellar width; appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except clypeus narrowly yellowish brown or reddish brown adjacent to lamella, mandible yellowish brown basally (brown apically), antenna reddish brown, and pronotal lobe black or reddish brown (yellow apically in most specimens). Forecoxal venter yellowish brown in specimen from Northern Territory. Femora, tibiae, and tarsi reddish brown.

♀.— Orbital fovea well defined, its width about 0.4 × ocellocular distance. Clypeal lamella with one lateral, nonprominent tooth on each side (Fig. 53c). Dorsal length of flagellomere I 0.8 × apical width, of flagellomere II 0.6 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with six or seven rake spines, longest spine equal to 1.8 × basitarsus width. Setae of pygidial plate not concealing integument; many

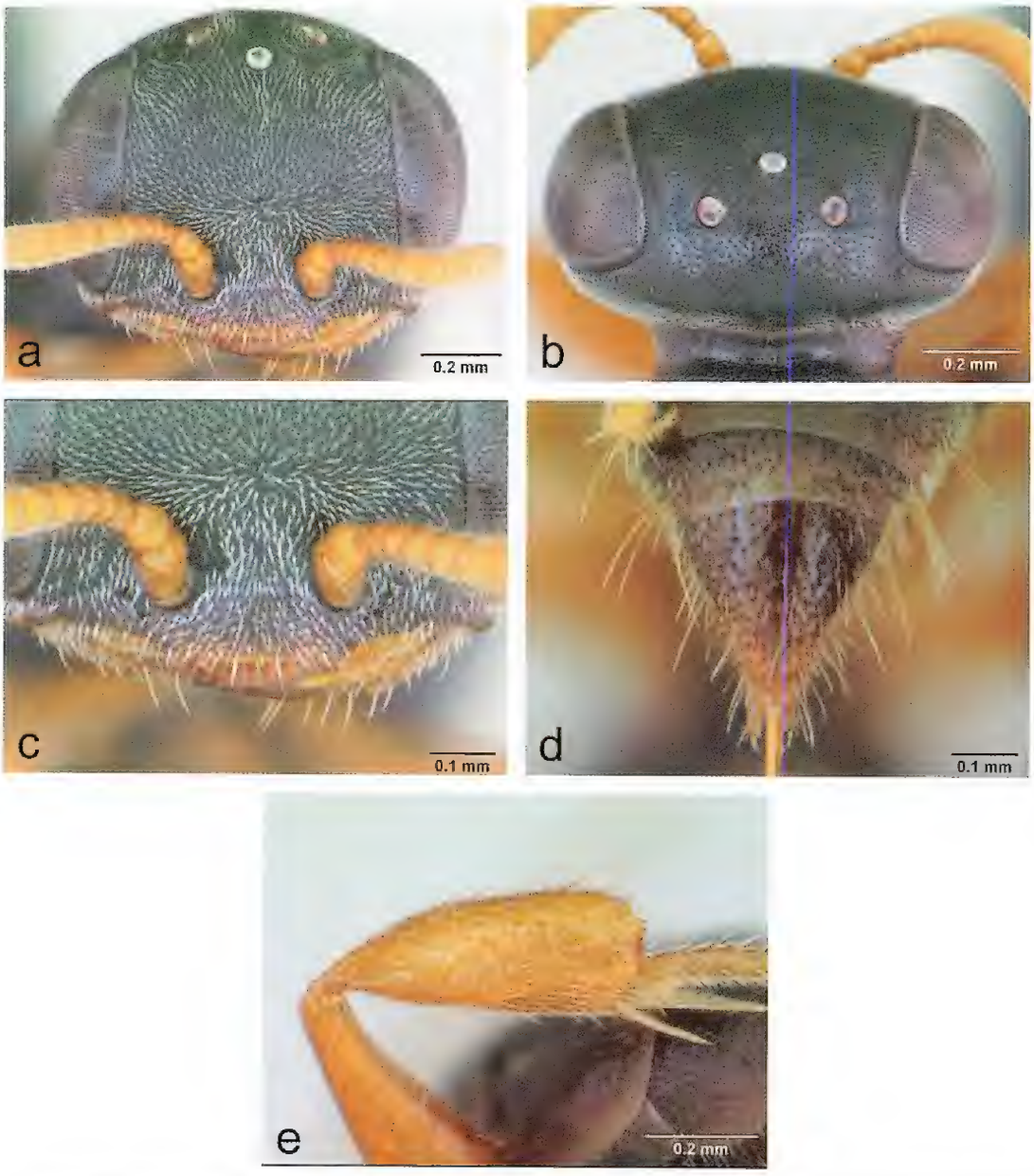

FIGURE 53. *Sericophorus deserticola* Pulawski, sp. nov.: a – female head in frontal view; b – female head in dorsal view; c – female clypeus in frontal view; d – apex of female gaster in dorsal view; e – female hindtibia in lateral view.

punctures in some specimens two diameters apart mesally (Fig. 53d). Length 2.4–3.8 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 52).— Known from two localities: one in southern part of Northern Territory, the other in southeastern South Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **South Australia**: 14 km WNW Renmark at 34°07'S 140°37E, 7 Nov–13 Dec 1995, K.R. Pullen (ANIC). PARATYPES: **AUSTRALIA**: **Northern Territory**: Areyonga, 8 Dec, no year or collector but probably H.K. Townes (1 ♀, AEI). **South Australia**: same data as holo-

type (1 ♀, ANIC); same data as holotype but 28 Mar–2 May 1995 (1 ♀, ANIC) and 23 Jan– 20 Feb 1996 (1 ♀, ANIC).

Sericophorus dipteroides Turner

Figures 52, 54, 55.

Sericophorus dipteroides Turner, 1907:275, ♀. Holotype or syntypes: ♀, Australia: Queensland: Cairns, but labeled Kuranda (BMNH), examined by O. Lom-holdt.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:252 (in catalog of Australian Sphecidae).— As *Zoyphium dipteroides*: Turner, 1912:60 (new combination), 1914:354 (in revision of Australian *Zoyphium*).

Zoyphium hackeri Cockerell, 1932:117, ♀. Holotype or syntypes: ♀: Australia: Queensland: Kuranda (QMB), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— As *Sericophorus hackeri*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:252 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus dipteroides* is easily recognized by its coloration: the thorax, propodeum, and gastral segment I (at least basally) are reddish brown (Fig. 54a), whereas the remaining gaster is black or brownish. *Sericophorus kurandae* is similar, but it has the entire gaster reddish brown. Also, in *dipteroides*, the frons is all setose, the setae are suberect on the interocellar area, the pronotal collar does not attain the level of scutum, and the scutal flange is not expanded. In *kurandae*, the frons has an asetose area above the antennal base, the setae of the interocellar area are appressed, the pronotal collar attains the level of scutum, and the scutal flange is expanded (Fig. 219d).

Description.— Frontal punctures minute, about one diameter apart; frontal line shallow, reaching anterior ocellus. Ocellocular distance equal to 0.7 × hindocellar width. Pronotal collar not attaining level of scutum. Scutal punctures about one diameter apart; scutal flange gradually narrowing posterad. Mesopleural punctures about two diameters apart near center. Propodeal dorsum minutely punctate, with median carina within conspicuous, glabrous median sulcus; side and posterior surface

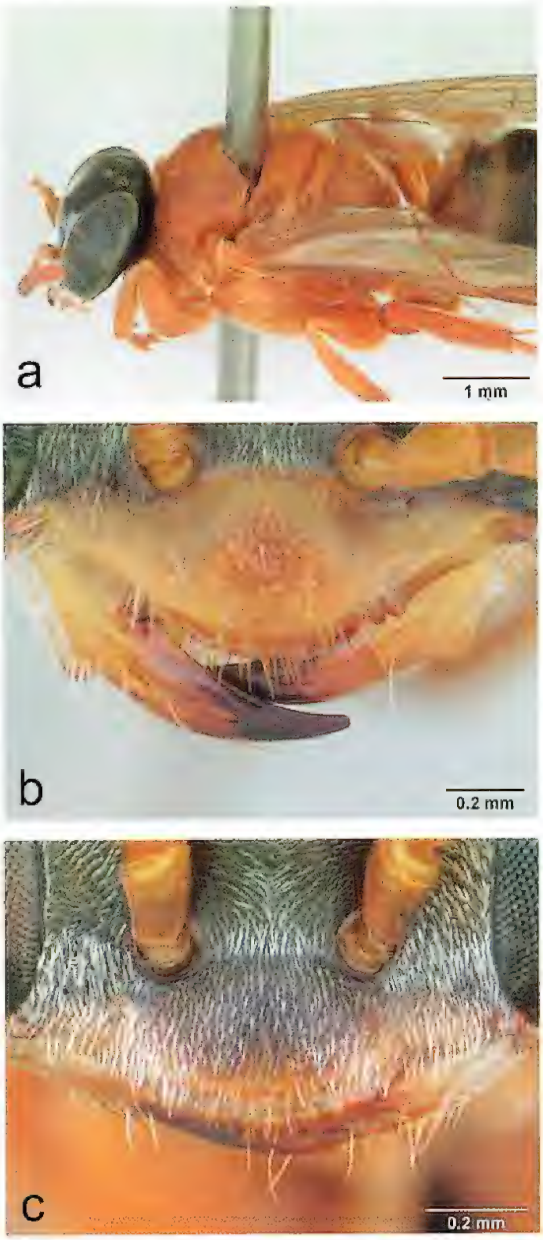

FIGURE 54. *Sericophorus dipteroides* Turner: a – anterior portion of female body; b – female clypeus in frontal view; c – male clypeus in frontal view.

unsculptured, but separated by conspicuous oblique ridges. Forewing vein M interstitial with cu-a; second submarginal cell triangular or nearly so. Tergal punctures minute, on horizontal area of tergum I averaging about 2–3 diameters apart in female, about two diameters in male; basal declivity shallowly concave; apical depressions of terga I and II minutely punctate.

Setae not obscuring integument on frons; erect on interocellar area, suberect on postocellar area, markedly shorter than midocellar width; on scutum suberect, markedly shorter than midocellar width; oriented anterad on propodeal dorsum.

Head black except the following: clypeus reddish brown in female, only ventrally so in male; mandible yellow basally, reddish brown mesally, dark brown apically; antenna reddish brown. Thorax, propodeum, and legs reddish brown. Gastral segment I reddish brown (at least basally), remaining segments black or brownish with faint violet tinge.

♀.— Orbital fovea a low swelling, almost unsculptured except for a few punctures. Clypeus: Fig. 54b. Dorsal length of flagellomere I 1.2 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X 1.5 × basal width. Forebasitarsus with 6–8 rake spines. Setae of pygidial plate partly obscuring integument. Length 7.0–7.5 mm.

♂.— Clypeal lamella with one lateral tooth on each side (Fig. 54c). Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.7 × basal width. Forebasitarsus with five rake spines. Sternum VIII: Fig. 55a. Genitalia: Fig. 55b. Length 5.0 mm.

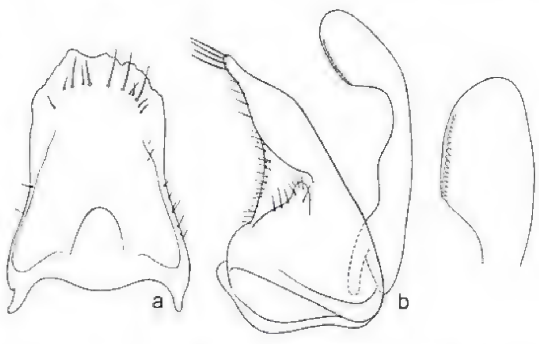

FIGURE 55. *Sericophorus dipteroides* Turner: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

GEOGRAPHIC DISTRIBUTION (Fig. 52).— Known from one locality in Queensland.

RECORDS.— AUSTRALIA: Queensland: Kuranda (1 ♀, BMNH, strongly damaged; 1 ♀, QMB, holotype of *Zoyphium hackeri*), Apr 1902 (1 ♀, BMNH, holotype of *dipteroides*), 16 May 1958 (1 ♂, AMS).

Sericophorus doddi (Turner)

Figures 56–58.

Zoyphium doddi Turner, 1912:59, ♂. Holotype: ♂, Australia: Queensland: Cairns (BMNH), examined by O. Lomholdt and W. Pulawski.— Turner, 1914:357 (in revision of Australian *Zoyphium*).— As *Sericophorus doddi*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:252 (in catalog of Australian Sphecidae).

RECOGNITION.— *Sericophorus doddi* has the setae appressed on the upper frons and postocellar area and the coxae yellow. It differs from similar species in having a narrow, glabrous area adjacent to clypeal lamella (Fig. 56a, b) in combination with the coarsely rugose posterolateral portion of the propodeal dorsum. Subsidiary recognition features are: antennal socket separated from clypeal free margin by about socket width; clypeus yellow, tegula and humeral plate yellow; legs (including coxae) lemon yellow; forewing vein M interstitial with cu-a.

DESCRIPTION.— Frontal punctures minute, almost compressed against each other; frontal line short, linear impression in female, almost reduced to puncture in male. Antennal socket separated from clypeal free margin by about socket width. Ocellocular distance equal to 0.5 × hindocellar

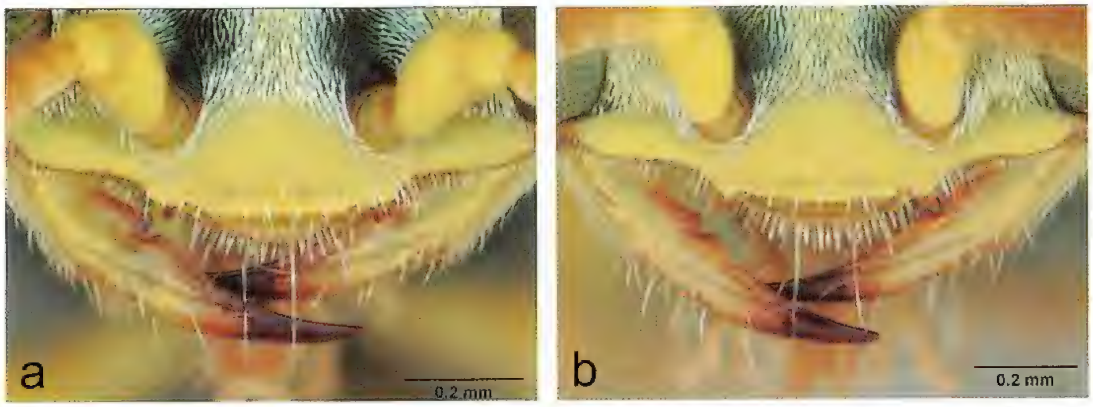

FIGURE 56. *Sericophorus doddi* (Turner): a – female clypeus in frontal view; b – male clypeus in frontal view.

width. Clypeus with narrow, glabrous area adjacent to lamella. Scutal punctures less than one diameter apart anteriorly, slightly more than one diameter apart posteriorly; scutal flange ending abruptly. Mesopleural punctures minute, superficial, more than one diameter apart below scrobe. Propodeum short, dorsal and posterior surfaces forming almost right angle; dorsum obliquely ridged (interspaces minutely punctate) or ridges evanescent, with well-defined median carina, conspicuously rugose posterolaterally; side microareolate anteriorly, ridged posteriorly (ridges extending onto posterior surface except for median sulcus), with sublateral, longitudinal carina that may be sharp or ill defined. Forewing vein M interstitial with cu-a or diverging from M+Cu distad of cu-a; second submarginal cell triangular or narrowly open anteriorly. Terga with small but well-defined punctures (interspaces almost unsculptured), apical depressions impunctate, punctures more than one diameter apart on horizontal area of tergum I (except less than one diameter laterally).

Setae short, intensely golden, totally concealing integument on frons (but not on clypeus); appressed on upper frons and postocellar area; oriented anterad on propodeal dorsum.

Body black except the following: clypeus yellow, mandible yellow with reddish brown apex, scape and pedicel yellow, flagellum light yellowish brown, pronotal lobe yellow distally in most specimens, tegula and humeral plate yellow, legs (including coxae) bright lemon yellow.

♀.— Orbital fovea ill-defined or absent. Clypeal lamella straight between lateral teeth (Fig. 56a). Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 0.7 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with five or six short rake spines. Length 4.2–5.1 mm

♂.— Clypeal lamella slightly arcuate between lateral teeth; two lateral teeth present on each side (Fig. 56b). Dorsal length of flagellomere I 0.7 × apical width, of flagellomere II 0.6 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with five rake spines. Sternum VIII: Fig. 67a. Genitalia: Fig. 57b. Length 3.9 mm.

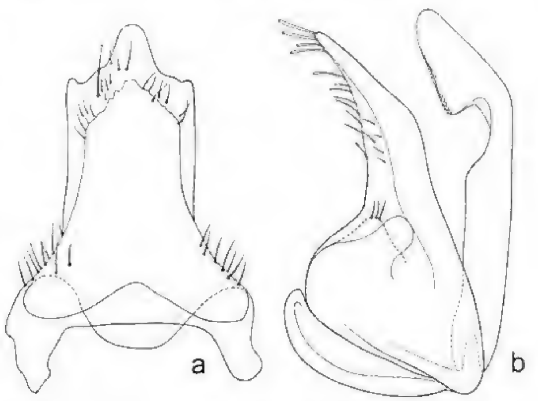

FIGURE 57. *Sericophorus doddi* (Turner): a – male sternum VIII; b – male genitalia in lateral view.

Geographic distribution (Fig. 58).— Northern Queensland and northern Western Australia.

Records.— AUSTRALIA: Queensland: Cairns (1 ♂, BMNH, holotype of *Zoyphium doddi*); Mareeba: Granite Gorge, 20 Jan 1999 (1 ♀, CAS). **Western Australia**: Broome, 1 Mar 1973 and 17 Dec 1975, on *Eucalyptus* sp. (2 ♀, UQIC); 7 km E Kununurra, 12–13 Dec 1975, on *Eucalyptus* sp. (2 ♀, CAS; 14 ♀, 1 ♂, UQIC).

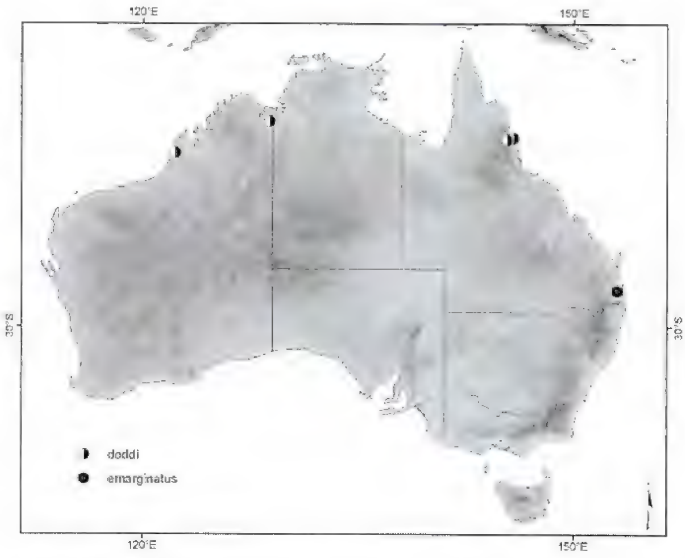

Figure 58. Collecting localities of *Sericophorus doddi* and *emarginatus*.

***Sericophorus emarginatus* (Hacker and Cockerell)**
Figures 58–60.

Zoyphium emarginatum Hacker and Cockerell, 1922:285, ♀, ♂. Lectotype:♀, Australia: Queensland: Brisbane (QMB), **present designation by O. Lomholdt**, examined by O. Lomholdt and W. Pulawski.— As *Sericophorus emarginatus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:252 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus emarginatus*, *lissonotus,* and *niger* are unique in having a conspicuously emarginate pronotal collar (Fig. 59e). *S. lissonotus* differs in having the scutal punctures one to two diameters apart near the center of the scutum, and several diameters apart near the center of the mesopleuron (less than one diameter apart and about one diameter apart, respectively, in the other two species). *S. emarginatus* and *niger* differ in color and in the shape of the female middle clypeal section, whose lamella is slightly more arcuate in *emarginatus* (compare Figs. 59a and 130a). The color differences include the following: in *emarginatus*, a part of femora and the tibiae are reddish brown, in the female the clypeus is narrowly reddish along the clypeal lamella, the apical depressions of terga I and II and tergum VI are reddish brown, and in the male the pronotal lobe is black. In *niger*, the clypeus, femora, tibiae, and gaster are all black, and in the male the pronotal lobe is pale yellow.

Status of the species.— *Sericophorus emarginatus* and *niger* are known only from the Brisbane area, and differ in the details of color and in the shape of the female middle clypeal section. Since only a handful of specimens are known, it is difficult to know how constant these differences are. The identical male sternum VIII and the genitalia speak in favor of one species.

Description.— Frontal punctures minute, nearly compressed against each other; frontal line ill defined. Ocellocular distance equal to 1.0–1.1 × hindocellar width. Clypeal lamella arcuate (Fig. 59a, b). Each ocellus in shallow depression. Pronotal collar conspicuously emarginate mesally, and also broadly emarginate posterolaterally (Fig. 59e). Scutal punctures less than one diameter apart; interspaces nearly unsculptured; scutal flange gradually narrowing toward apex. Mesopleural punctures about one diameter apart near center; interspaces nearly unsculptured. Propodeal dorsum

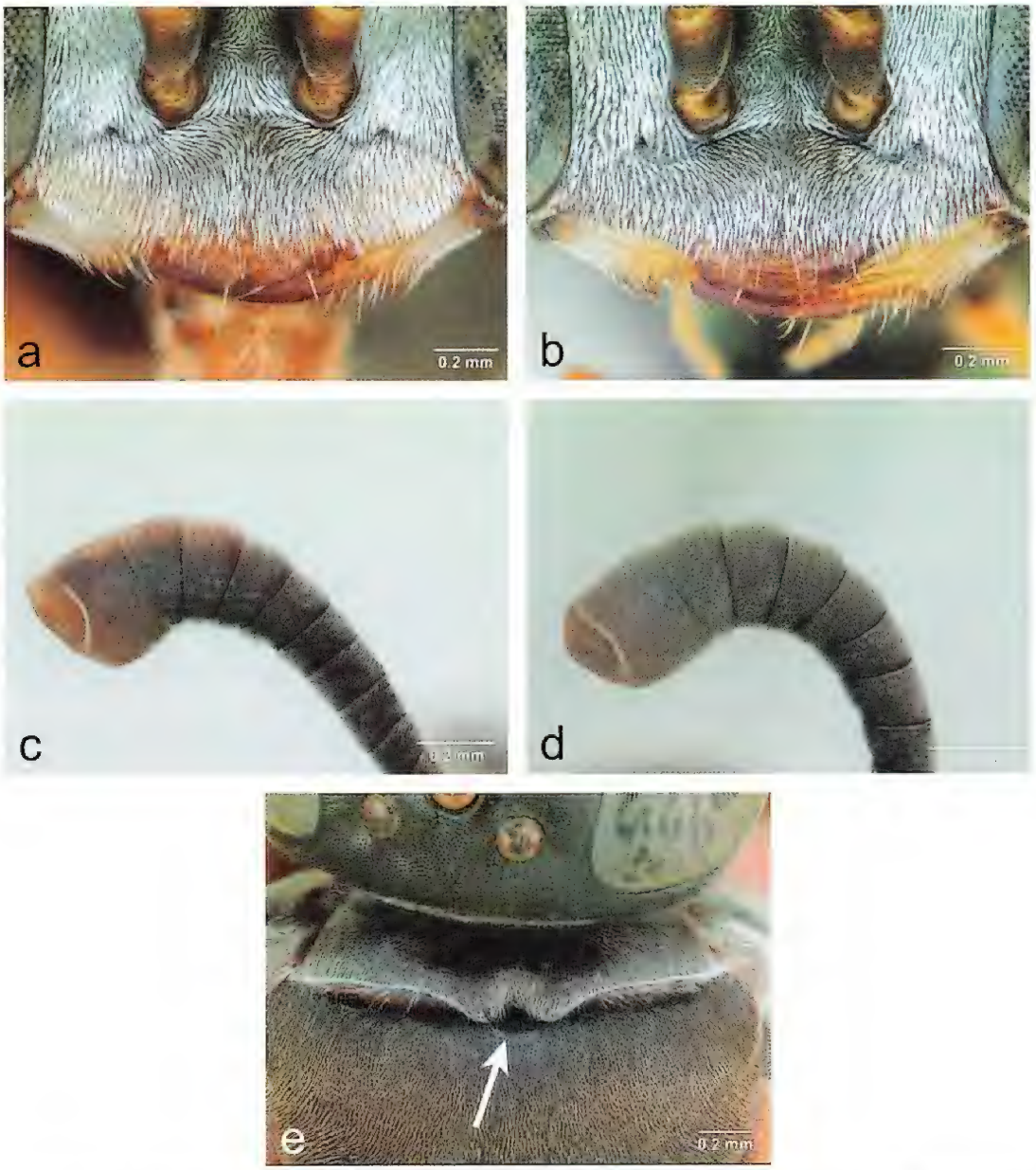

FIGURE 59. *Sericophorus emarginatus* (Hacker and Cockerell): a – female clypeus in frontal view; b – male clypeus in frontal view; c – apex of female antenna; d – apex of male antenna; e – female pronotum in dorsal view (arrow indicates pronotal emargination).

obliquely ridged, punctate between ridges, with shallow median sulcus in female and median impression in male, with median carina inside sulcus or impression, respectively; side practically unsculptured except ridged dorsally and punctate posteriorly; posterior surface punctate and with evanescent ridges except for median sulcus. Forewing vein M diverges from M+Cu basad of cu-a; second submarginal cell triangular. Punctures of horizontal part of tergum I minute, about one diameter apart; apical depressions of terga I and II punctate.

Setae silvery, obscuring integument on lower frons laterally and on clypeus; appressed on upper frons, postocellar area, and scutum; inclined anterad on propodeal dorsum (median sulcus or impression glabrous).

Head, thorax, and propodeum black except the following: clypeus reddish brown along lamella (lateral clypeal section partly yellow in female); mandible yellow basally, dark brown apically; antenna black, reddish brown ventrally; pronotal lobe reddish brown. Forefemur black except apically, midfemur black basally (also hindfemur in male), remainder reddish brown; female hindfemur reddish brown; tibiae and tarsi reddish brown. Gaster black, in female apical depressions of terga I and II and tergum VI reddish brown.

♀.— Inner lateral tooth of clypeal lamella ill defined (Fig. 59a). Orbital fovea absent. Antenna markedly clavate (Fig. 59c); dorsal length of flagellomere I 0.9 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.5 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with six or seven rake spines. Pygidial setae completely concealing integument. Length 7.0–8.0 mm.

♂.— Clypeal lamella rounded laterally (Fig. 59b). Antenna markedly clavate (Fig. 59d); dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.7 × apical width; greatest length of flagellomere IX 0.5 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with 4–6 rake spines. Sternum VIII narrowly emarginate apically (Fig. 60a). Genitalia: Fig. 60b. Length 5.0–6.5 mm.

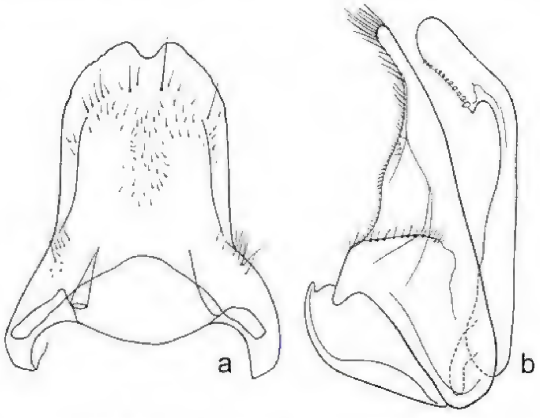

FIGURE 60. *Sericophorus emarginatus* (Hacker and Cockerell): a – male sternum VIII; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 58).— Known only from Brisbane, Queensland.

RECORDS.— **AUSTRALIA**: **Queensland**: Brisbane, 3 Oct 1916 (1 ♀, QMB, lectotype of *Zophium emarginatum*), 3 Oct 1916, 10 Oct 1916, 22 Oct 1917 and 25 Sept 1919 (2 ♂, BMNH; 2 ♀, 1 ♂, QMB; 1 ♀, 1 ♂, USNM, paralectotypes of *Zoyphium emarginatum*).

Sericophorus erythrosoma (Turner)

Figures 61–63.

Zoyphium erythrosoma Turner, 1908:493, ♀, ♂. Lectotype: ♀, Australia: Queensland: Townsville (BMNH), **present designation by O. Lomholdt**, examined by O. Lomholdt and W. Pulawski.— Turner, 1914:355 (in revision of Australian *Zoyphium*).— As *Sericophorus erythrosoma*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:252 (in catalog of Australian Sphecidae).

RECOGNITION.— *Sericophorus erythrosoma* has the setae appressed on the postocellar area, the thorax without yellow markings, the frons, scutum, and propodeal dorsum with a metallic, bluish luster (greenish or bronzy in some specimens), a reddish brown gaster, and at least the midfemur with a pale yellow apical spot. Additionally, the clypeal lamella is arcuate (Fig. 61a, b).

DESCRIPTION.— Inner orbits almost parallel in male. Frons slightly impressed above antennal socket; frontal punctures minute, averaging about one diameter apart; frontal line extending to midocellus or nearly so. Ocellocular distance equal to 0.9–1.0× hindocellar width. Interocellar area convex adjacent to hindocellus, concave mesally. Clypeal lamella arcuate (Fig. 61a, b). Scutal punctures less than one diameter apart; scutal flange ending abruptly. Mesopleural punctures about

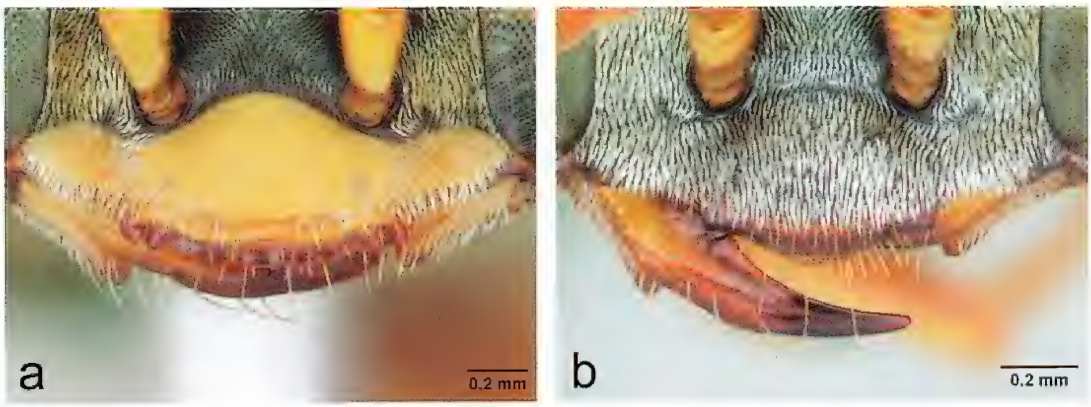

FIGURE 61. *Sericophorus erythrosoma* (Turner): a – female clypeus in frontal view; b – male clypeus in frontal view.

one diameter apart near center or slightly more. Propodeal dorsum punctate, with glabrous median area widened and depressed apically (depressed area crossed by fine ridges in most specimens); median carina mostly present, but absent in some specimens; side punctate and shiny, unsculptured anteriorly or nearly so; posterior surface punctate except for median sulcus, unsculptured, shiny mesodorsally. Forewing vein M diverging from M+Cu basad of cu-a in most specimens, but interstitial with cu-a in some; second submarginal cell conspicuously narrowed anteriorly or triangular. Preapical portions of terga I and II mesally with punctures that are several to many diameters apart, apical depressions impunctate or with a few sparse punctures (except punctate laterally).

Setae silvery or golden on frons, appressed on upper frons, postocellar area, and scutum, not obscuring integument; on interocellar area suberect, about as long as 0.25 × midocellar width; on propodeal dorsum suberect, oriented obliquely anterad (integument glabrous along midline, broadly so near apex).

Frons, thorax, and propodeum with metallic, bluish luster (greenish or bronzy in some specimens) except pronotum, scutellum, and metanotum black. Clypeus yellow in most female, but black in that from Darwin District, Northern Territory, and black in male (narrowly reddish brown along lamella). Scape yellow, flagellum reddish brown. Mandibles yellow basally in female, yellowish red in male, dark brown apically. Femora black, partly reddish (particularly hindfemur), with large yellow spot apically (that may be absent on hindfemur); tibiae in female predominantly reddish brown, yellow dorsally, in male predominantly yellow, reddish brown ventrally; tarsi reddish brown. Gaster reddish brown.

♀.— Orbital fovea well defined, about as wide as one third of ocellocular distance. Dorsal length of flagellomere I 0.9–1.0 × apical width, of flagellomere II 1.0–1.2 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with five to seven rake spines. Pygidial setae concealing integument except basally. Length 6.5–11.3 mm.

♂.— Lateral corner of clypeal lamella angulate (Fig. 61b). Forebasitarsus with four or

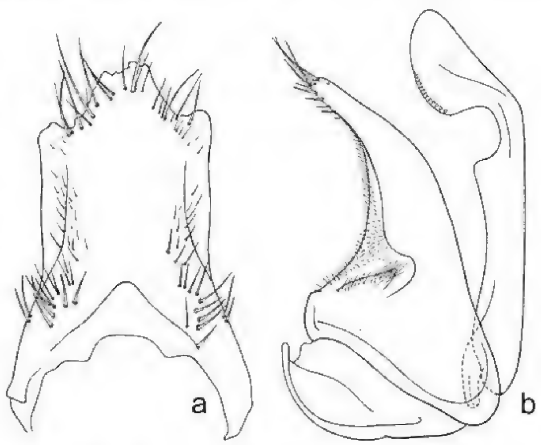

FIGURE 62. *Sericophorus erythrosoma* (Turner): a – male sternum VIII; b – male genitalia in lateral view.

five rake spines. Dorsal length of flagellomere I 0.8 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.4 × basal width. Sternum VIII: Fig. 62a. Genitalia: Fig. 62b. Length 6.0–7.4 mm.

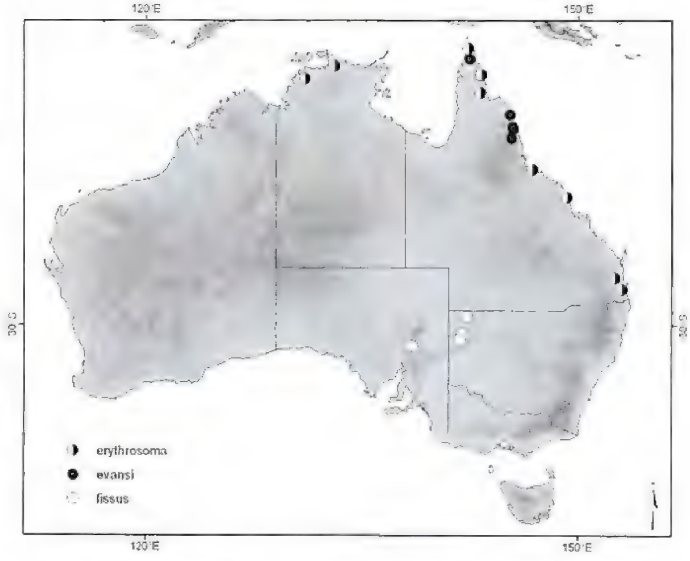

FIGURE 63. Collecting localities of *Sericophorus erythrosoma*, *evansi*, and *fissus*.

GEOGRAPHIC DISTRIBUTION (Fig. 63).— Northern Territory and Queensland.

RECORDS.— AUSTRALIA: Northern Territory: Cooper Creek 19 km SE Mt. Borradaile at 12°06′S 133°04′E, 5–6 June 1973 (1 ♂, ANIC); Darwin District, 26 Jan 1928 (1 ♀, AMS). **Queensland**: Bamaga, 3–15 Jan 1984 (1 ♀, AEI); 4 km NE Batavia Downs at 12°39′S 142°42′E, 11 Dec 1992–17 Jan 1993 (1 ♀, ANIC); Brisbane, 15 Feb 1916 (1 ♀, 1 ♂, AMNH), 8 and 15 Feb 1916, 12 and 26 Feb 1918, 6, 7 and 13 Mar 1918 (2 ♀, 3 ♂, CAS; 11 ♀, 20 ♂, QMB, five females incorrectly labeled as paratypes; 1 ♀, USNM), 7 Mar 1918 (1 ♂, QMB, labeled as paratype of *Zoyphium splendidum* by Hacker); Coen at 13°57′S 143°12′E, 16 Nov–17 Dec 1993 (1 ♀, ANIC); Claudie River 1 mi. W Mount Lamont, 20 Dec 1971 (1 ♀, AMS); East Claudie River in Iron Range National Park at 12°42′37″S 143°17′32″E, 2 Jan 1996 (1 ♀, UQIC); Mackay, Mar 1905 (1 ♂, BMNH, paralectotype of *erythrosoma*); Sunday Creek Environmental Studies Centre in Jimna State Forest at 26°42′46″S 152°32′13″E, 15 Mar 1996 (1 ♂, UQIC); Townsville, 26 Feb 1902 (BMNH, lectotype of *erythrosoma*) and 25 Feb 1903 (BMNH, paralectotype of *erythrosoma*).

Sericophorus evansi Lomholdt, sp. nov.

Figures 63–65.

DERIVATION OF NAME.— Named after Howard E. Evans, who collected the holotype, in recognition of his vast contribution to our knowledge of sphecid wasps, in particular of the Australian Crabronidae.

RECOGNITION.— *Sericophorus evansi* can be recognized by the following combination: head, thorax, propodeum, gaster, and femora bluish green; setae erect on the upper frons and postocellar area; propodeum with oblique ridges between side and posterior face; propodeal dorsum with punctures that are about one diameter apart and shiny interspaces; antenna light reddish brown. Unlike *viridescens*, *evansi* has the median sulcus of the propodeal dorsum narrower than the length of the metanotum (rather than as wide as the length of the metanotum); the mesopleuron unsculptured mesally between punctures (rather than microsculptured); the outer lateral tooth of the middle clypeal section nonprominent (Fig. 64a) rather than prominent; the greatest length of flagellomere V 0.8 × apical width (rather than 0.6 ×); and the rake of the female forebasitarsus shorter (length of apical spine about 1.3–1.5 × basitarsus apical width, rather than 1.8 ×).

DESCRIPTION.— Frons swollen near center; frontal punctures averaging about one diameter apart, more than that near top of swelling; frontal line in female short, represented by unsculptured stripe, in male extending to midocellus; interocellar area convex adjacent to hindocellus, concave

mesally. Ocellocular distance equal to 0.7 × hindocellar width in female, 0.8 × in male. Scutal punctures averaging more than one diameter apart near center; scutal flange widest preapically, gradually narrowing toward apex. Scutellum markedly convex, unsculptured mesally between punctures. Mesopleural punctures well defined, averaging 2–3 diameters below scrobe, interspaces unsculptured mesally. Propodeal dorsum punctate (punctures about one diameter apart, interspaces shiny); adjacent to foremargin with deep, crenulate sulcus that extends mesally into well-defined, longitudinal sulcus; the latter glabrous, with several transverse carinae, anteriorly also with median carina; side finely punctate, delimited from posterior surface by oblique ridges, with no longitudinal ridge; posterior surface punctate except for median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell conspicuously narrowed anteriorly. Tergal punctures about 1–2 to 2–3 diameters apart; anterior declivity of tergum I concave; apical depressions of terga I and II punctate.

Setae silvery on frons and clypeus, partly obscuring integument on lower frons laterally in female; erect on upper frons and postocellar area, on interocellar area about as long as 0.8 × midocellar width; conspicuous, appressed, silvery on pronotal collar (concealing sculpture); on scutum dark, about as long as 0.5 midocellar width; conspicuous, inclined on propodeal dorsum.

Head, thorax, propodeum, gaster and femora bluish green except the following: clypeus in female reddish brown along lamella; mandible basally yellow (female) of reddish brown (male), dark brown apically; antenna light reddish brown; pronotal lobe partly reddish in female; forefemur apically reddish brown on inner side; tergum VI brown. Foretibia and apical tarsomeres reddish brown, mid- and hindtibia and remaining tarsomeres black, midtibia partly reddish brown in one female.

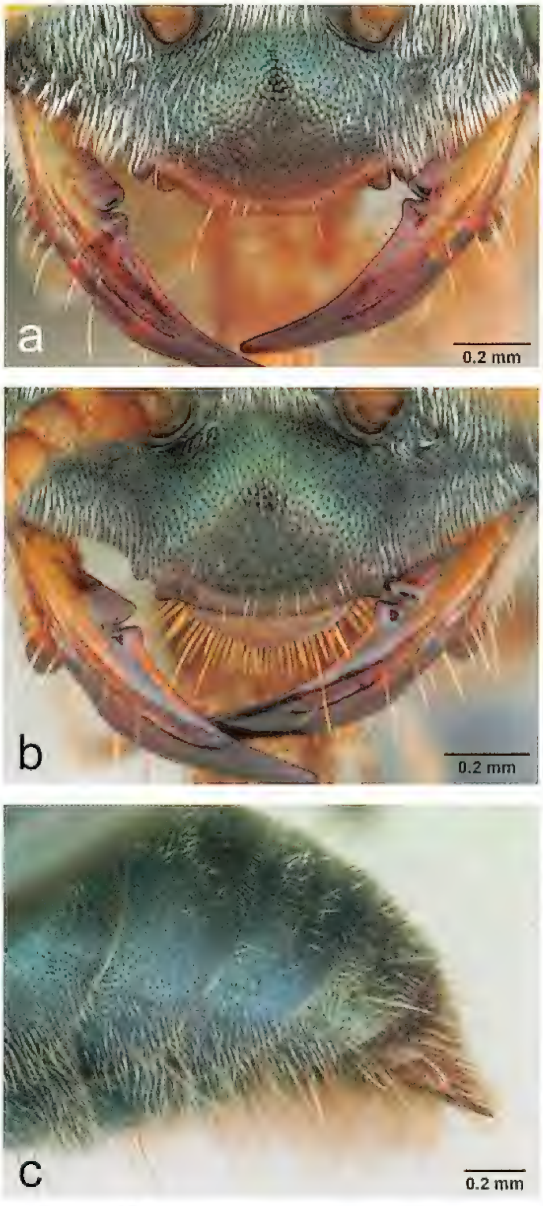

FIGURE 64. *Sericophorus evansi* Lomholdt, sp. nov: a – female clypeus in frontal view; b – male clypeus in frontal view; c – posterior part of male gaster in lateral view.

♀.— Orbital fovea rudimentary. Clypeal lamella arcuate (Fig. 64a). Dorsal length of flagellomeres I and II 1.4 × apical width; greatest length of flagellomere IX 1.0 × apical width, of flagellomere X 1.1 × basal width. Forebasitarsus with seven rake spines, length of apical spine equal to 1.3–1.5 × basitarsus apical width, Setae of pygidial plate not concealing integument. Length 7.5 mm.

♂.— Clypeus: Fig. 64b. Dorsal length of flagellomeres I and II 1.1 × apical width; greatest length of flagellomere IX 1.1 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with five rake spines. Sterna IV-VI with abundant erect setae (Fig. 64c), setal length about equal to hindtarsomere II. Sternum VIII emarginate apically (Fig. 65a). Genitalia: Fig. 65b. Length 6.7 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 63).— Queensland.

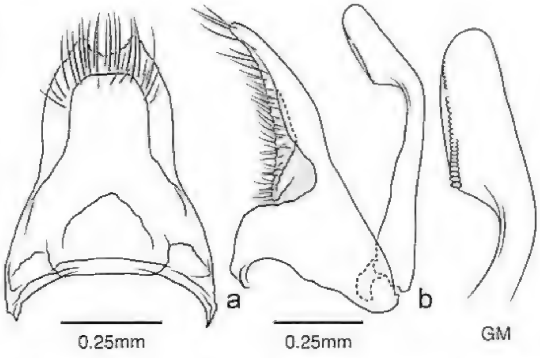

FIGURE 65. *Sericophorus evansi* Lomholdt, sp. nov: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

MATERIAL EXAMINED.— HOLOTYPE: ♀, **AUSTRALIA**: **Queensland**: Cooktown, 1–2 May 1987, H.E. and M.A. Evans (ANIC). PARATYPES: **AUSTRALIA**: **Queensland**: Cockatoo Creek crossing 17 km NW Heathlands at 11°39′S 142°27′E, 26 Jan–29 Feb 1992, O. Feehney (1 ♀, ANIC); Cooktown, 1–2 May 1987, H.E. and M.A. Evans (1 ♀, CAS); 15 km SW Mareeba, 18 Apr 1987, H.E. and M.A. Evans (1 ♀, CAS); Port Douglas, H.E. and M.A. Evans, 25 Apr 1980 (1 ♀, UQIC) and 11 May 1987 (1 ♀, CAS); Wonga Beach 11 km NNE Mossman at 16°19.9′S 145°25.3′E, 9 May 2007, V. Ahrens and W.J. Pulawski (1 ♂, CAS).

Sericophorus fissus Lomholdt, sp. nov.

Figures 63, 66, 67

NAME DERIVATION.— *Fissus*, Latin for *split*; with reference to the divided female clypeus.

RECOGNITION.— Both sexes of *fissus* share an unusual basolateral carina on tergum I that is transversely expanded apically (Fig. 66d), although this character is difficult to see in the male because of the carina's small size. The female has a unique clypeus, with a conspicuous, hollow, deeply divided expansion (Fig. 66a, c), and a unique sternum I that has a conspicuous, narrow, elongate process (Fig. 66e). The male can be recognized by its emarginate clypeal lamella (Fig. 66b), and an unusually high median carina on sternum I (Fig. 66f). Additionally, the pronotal collar is pale yellow and the scutum is black.

DESCRIPTION.— Head transverse in frontal view, maximum width 1.18 × maximum height in female, 1.25 × in male (measured from clypeus ventral margin to top of vertex). Frontal punctures almost contiguous, concealed by vestiture; frontal line fine, extending to above frons midheight. Ocellocular distance equal to hindocellar width. Propleuron expanded posterolaterally (expansion oriented anterad). Scutal and mesopleural punctures less than one diameter apart, interspaces unsculptured, shiny; scutal flange ending abruptly. Axilla somewhat expanded, slightly overhanging lateral fossa. Propodeal dorsum with basal impression that is intersected by short, longitudinal carinae, mesally with shallow, glabrous sulcus that contains median carina and series of transverse or oblique carinae; remaining dorsum punctatorugose; side punctatorugose except practically unsculptured anteriorly; posterior surface punctatorugose except for median sulcus. Forewing vein M interstitial with cu-a or diverging from M+Cu basad of cu-a (one female, one male); second submarginal cell triangular. Horizontal part of tergum I with punctures averaging about one diameter apart (apical depression impunctate); basolateral carina ending in front of spiracle as transverse expansion (Fig. 66d).

Setae short, fully concealing integument on frons (including interocellar area) and lateral portion of clypeus, golden in female, silvery in male; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

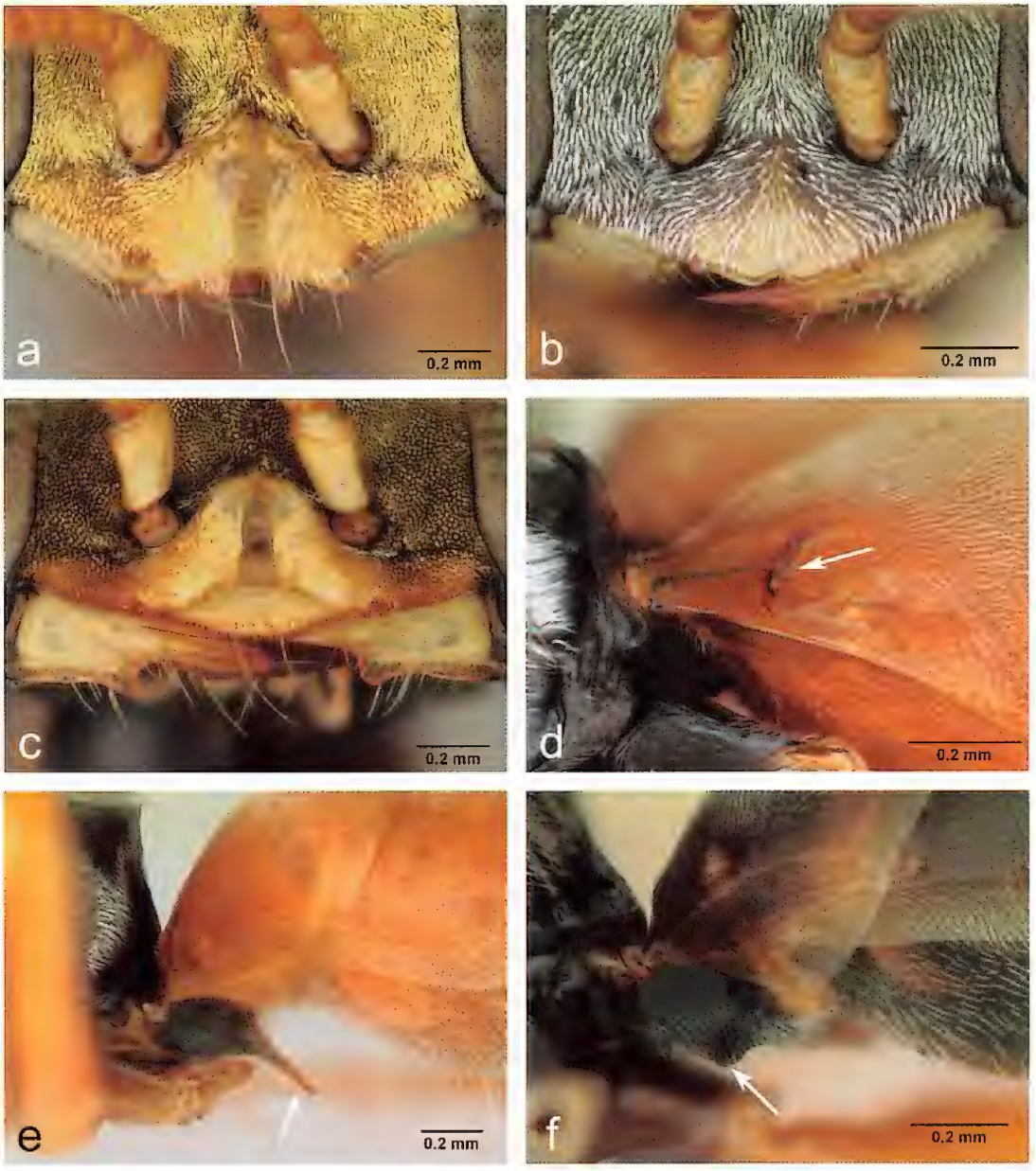

FIGURE 66. *Sericophorus fissus* Lomholdt, sp. nov: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female clypeus in ventral oblique view; d – female tergum I in lateral oblique view (arrow indicates transverse section of basolateral carina); d – base of female gaster in lateral view showing process on sternum I; e – base of female gaster in lateral view showing process on sternum I; f – base of male gaster showing elevated median crest.

Head, thorax, and propodeum black except the following: clypeus yellow (only apicomesally in male); mandible yellow, dark apically; scape and pedicel pale yellow, flagellum yellowish brown (brown dorsally in male); pronotal collar pale yellow; axilla with pale yellow spot in female paratype, spot evanescent in female holotype. Forecoxa pale yellow; femora reddish brown, fore-femur largely pale yellow (also midfemur and hindfemur apically in holotype), male midfemur pale

yellow apically; tibiae yellowish brown, female hindtibia reddish brown; tarsi reddish brown in female, yellowish brown in male. Gaster light reddish brown in female, black in male.

♀.— Orbital fovea ill defined, about as wide as 0.5 × ocellocular distance. Middle clypeal section with conspicuous, deeply emarginate elevation (elevation hollow beneath); lateral teeth of clypeal lamella not prominent (Fig. 66a, c). Dorsal length of flagellomere I equal to apical width, that of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate not obscuring integument. Sternum I with flat, elongate process that is slightly emarginate apically in holotype, deeply so in paratype. Length 6.0–6.5 mm.

♂.— Clypeal lamella emarginate mesally (Fig. 66b), shallowly so in one specimen. Dorsal length of flagellomere I 0.9 × apical width, that of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with three or four rake spines. Sternum I with elevated median crest (Fig. 66f). Length 4.6–5.0 mm. Sternum VIII: Fig. 67a. Genitalia: Fig. 67b.

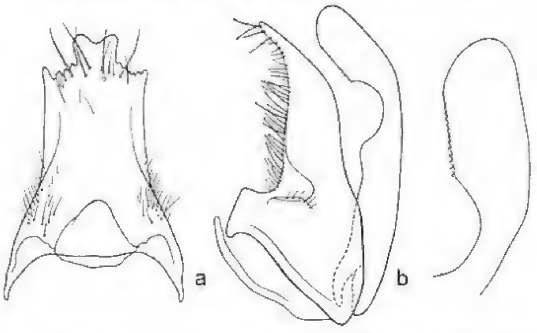

FIGURE 67. *Sericophorus fissus* Lomholdt, sp. nov: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

GEOGRAPHIC DISTRIBUTION (Fig. 63).— New South Wales and Southern Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: New South Wales:** 25 km E Tibooburra, 1 Nov 1949, E.F. Riek (ANIC). PARATYPES: **AUSTRALIA: New South Wales:** Packsaddle 111 mi. N Broken Hill, 31 Oct 1969, H.E. Evans (1 ♀, MCZ); Sandy Creek 79 mi. N Broken Hill, 31 Oct 1969, H.E. Evans (1 ♂, CAS). **South Australia:** Edeowie Homestead near Wilpena Pound, 29 Oct 1972, on flowers of *Heterodendron oleifolium*, H.E. Evans (1 ♂, USNM).

Sericophorus flavipes Pulawski, sp. nov.

Figures 68–70

NAME DERIVATION.— *Flavipes* derives from two Latin words: *flavus*, yellow, and *pes*, a foot; a noun in apposition to the generic name; with respect to the color of legs.

RECOGNITION.— *Sericophorus flavipes* is a small (length 4.4–4.6 mm in female, 3.6 mm in male), mostly black species, mainly characterized by the lack of specializations found elsewhere: the frons is densely punctate, the clypeus is non-emarginate and without elevation, the glossa is short (shorter than scape), the mandibular posterior margin is straight between the base and notch, the pronotal collar is not emarginate and reaches the level of the scutum, the propleuron is not expanded posterolaterally, the axilla is not expanded laterally, the subalar area is not expanded, the propodeal dorsum is finely punctate (except basally, mesally, and posterolaterally) and without sublateral carina, three submarginal cells are present, the forecoxa is black, the hindtibia is not swollen, the basolateral carina of tergum I ends well before the anterior margin of the spiracle, the apical depressions of terga I and II are impunctate, sternum I has no projection, and female tergum VI is densely punctate. It differs from similar species (*chrysophorus*, *laevigatus*) in having the antennal socket separated from clypeal free margin by the socket width (Fig. 68a, b) rather than about two diameters, the posterolateral portion of the propodeal dorsum coarsely rugose (Fig. 68c) rather than finely sculptured, the posterior propodeal surface ridged (except mesally) rather than

punctate, the clypeus yellow ventrally in female, all yellow in male rather than all black, and the legs (except coxae) pale yellow rather than reddish brown. The other two species are also larger, their length being 6.2–11.8 mm in female, 4.6–8.2 mm in male.

Description.— Frontal punctures ill defined, about one diameter apart. Frontal line not extending above frontal midheight. Antennal socket separated from clypeal free margin by socket width (Fig. 68a, b). Ocellocular distance equal to 0.8 × hindocellar width. Clypeal lamella in male rounded laterally, without teeth. Scutal punctures averaging about one diameter apart; scutal flange gradually narrowing posterad. Mesopleural punctures ill defined, about one diameter apart mesally. Propodeal dorsum longitudinally ridged near base, with glabrous, shallow median impression that contains median carina, with oblique carinae emerging from median carina, remaining surface densely punctate except coarsely ridged posterolaterally (Fig. 68c); side finely ridged except aciculate anteroventrally; posterior surface ridged (except mesally), with longitudinal, sublateral carina in ventral half; mesodorsal area of posterior surface ridged. Forewing vein M interstitial with cu-a or diverging from M+Cu slightly distad of cu-a; second submarginal cell narrowly opened anteriorly. Tergum I slightly concave anteriorly, punctures of horizontal area well defined, averaging about two diameters apart; apical depression impunctate except basally; apical depression of tergum II impunctate.

Setae of lower frons and clypeus golden,

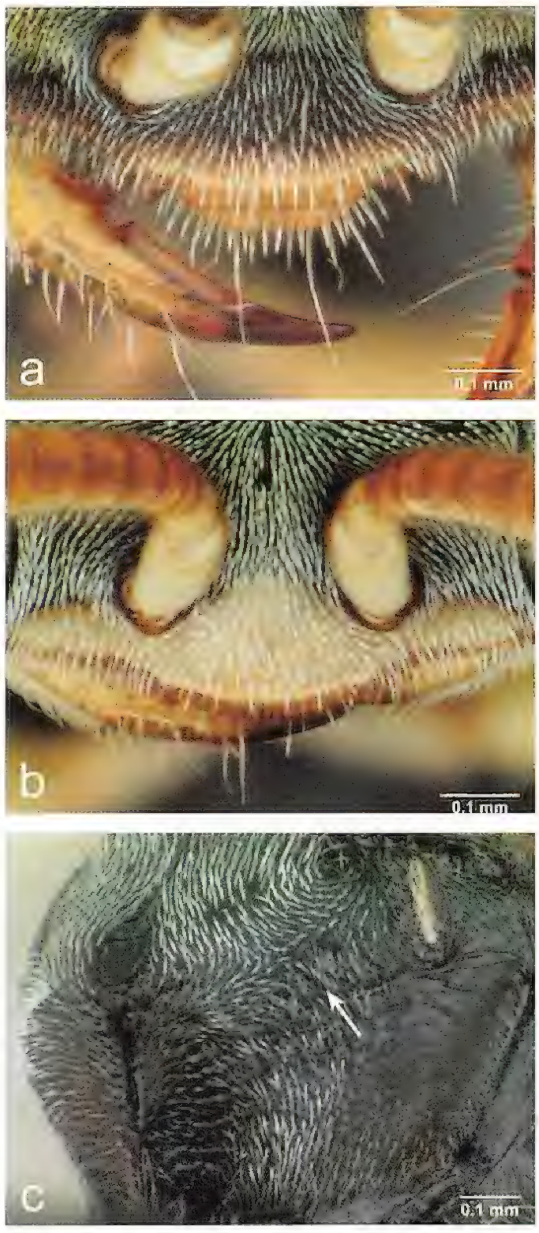

Figure 68. *Sericophorus flavipes* Pulawski, sp. nov.: a – female clypeus; b – male clypeus; c – female propodeum in lateral oblique view (arrow indicate coarsely sculptured area).

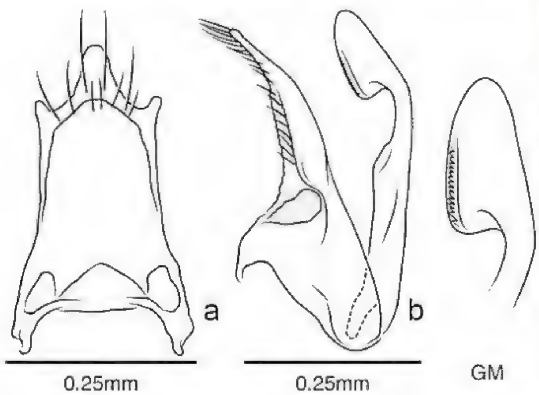

Figure 69. *Sericophorus flavipes* Pulawski, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

not obscuring integument; appressed on upper frons, interocellar and postocellar areas, and scutum; appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following are pale yellow: narrow ventral strip on clypeus in female, all clypeus in male, scape, and venter of pedicel; flagellum dark brown dorsally in female, light brown in male, yellowish brown ventrally. Trochanters, femora, tibiae, and tarsi pale yellow.

♀.— Orbital fovea ill defined, slightly wider than half ocellocular distance. Dorsal length of flagellomere I 1.2 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.7 × apical width; greatest length of flagellomere X 1.3 × basal width. Forebasitarsus with four to six rake spines. Setae of pygidial plate concealing integument near apex. Length 4.4–4.6 mm.

♂.— Free margin of clypeal lobe rounded laterally, without lateral teeth. Dorsal length of flagellomere I 1.0 × width, of flagellomere II 0.7 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.25 × basal width. Forebasitarsus with four rake spines. Sternum VIII: Fig. 69a. Genitalia: Fig. 69b. Length 3.6 mm.

Geographic distribution (Fig. 70).— Known from one locality in northern Queensland.

Records.— Holotype: ♀, **AUSTRALIA: Queensland**: Hann River at 15°11′S 143°52′E, 18 Dec 1993–14 Jan 1994, P. Zborowski and E.D. Edwards (ANIC). Paratypes: **AUSTRALIA: Queensland**: same data as holotype (1 ♀, ANIC; 1 ♀, CAS); same locality, 17 Nov–18 Dec 1993, P. Zborowski (1 ♀, 1 ♂, ANIC; 1 ♀, CAS).

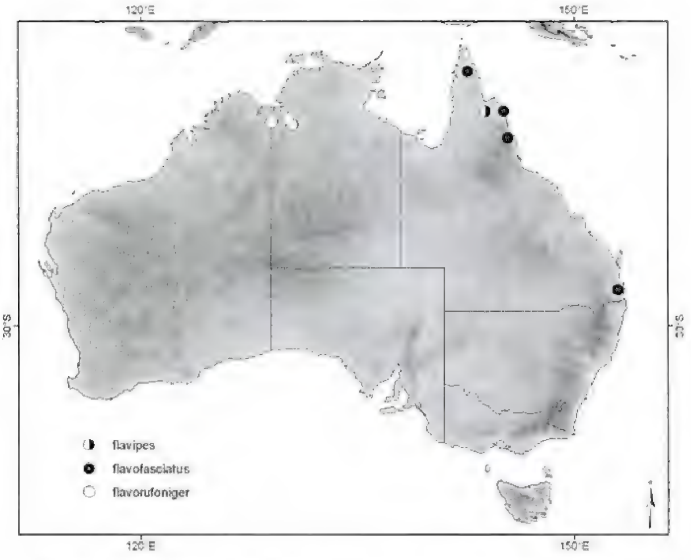

Figure 70. Collecting localities of *Sericophorus flavipes*, *flavofasciatus*, and *flavorufoniger*.

Sericophorus flavofasciatus (Turner)

Figures 70–72

Zoyphium flavofasciatum Turner, 1916a:126, ♂. Holotype: ♂, Australia: Queensland: Brisbane (BMNH), examined by O. Lomholdt and W. Pulawski.— Hacker and Cockerell, 1922:285 (description of ♀).— As *Sericophorus flavofasciatus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:252 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus flavofasciatus* has a unique sternum I, with a transverse lamella (curved posterad on each side) slightly behind the midlength, and a membranous, concave area between the lamella and the posterior margin (Fig. 71e). Subsidiary recognition characters are: mesothorax at least partly reddish brown; tergum I with conspicuously high basolateral carina that extends beyond the foremargin of the spiracle; terga I and IV-VI reddish brown (at least terga I and IV with pale yellow fascia), whereas terga II and III are contrastingly black. Sternum I is somewhat

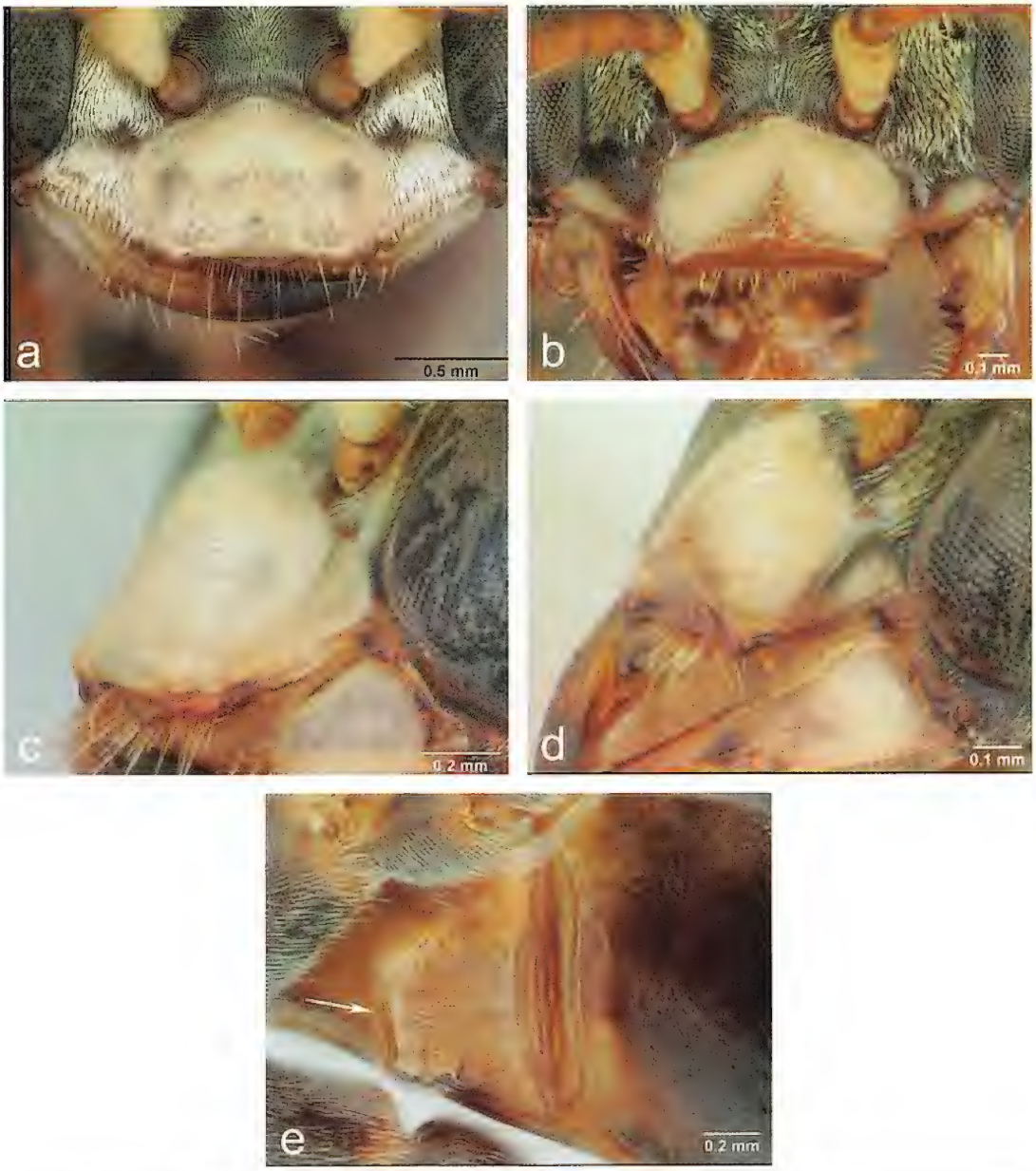

FIGURE 71. *Sericophorus flavofasciatus* (Turner): a – female clypeus in frontal view; b – male clypeus in frontal view; c – female clypeus in lateral oblique view; d – male clypeus in lateral oblique view; e – female sternum I (arrow indicates transverse lamella).

similar in *tuberculatus* in which, however, the frons has a prominent median tooth below the frontal midheight. No such structure is present in *flavofasciatus*.

DESCRIPTION.— Frontal punctures minute, most of them less than one diameter apart; frontal line ill defined. Ocellocular distance equal to 0.7 × hindocellar width. Middle clypeal section slightly elevated, with narrow, glabrous declivity between elevation top and free margin (Fig. 71a-d); declivity nearly vertical laterally in female, oblique in male, rounded mesally in both sexes.

Propleuron somewhat expanded posterolaterally (expansion oriented anterad). Scutal punctures averaging about one diameter apart; interspaces microsculptured, dull; scutal flange widest apically, rounded apically. Mesopleural punctures averaging about one diameter apart beneath scrobe; interspaces unsculptured. Propodeal dorsum, side, and posterior surface (except for median sulcus) finely punctate, side unsculptured anteriorly; dorsum with short longitudinal ridges along anterior margin, with sharp median carina in shallow, longitudinal depression. Forewing vein M diverging from M+Cu basad of, but close to, cu-a in female, interstitial in male; second submarginal cell triangular in female, narrowly truncate anteriorly in male. Tergum I with conspicuous basolateral carina that extends beyond spiracle; spiracle somewhat raised above tergal integument; tergum's horizontal area with punctures that average about two diameters apart; apical depressions of terga I and II punctate. Sternum I with median ridge basally, with conspicuous transverse lamella slightly behind midlength; lamella curved posterad on each side (Fig. 71e); area between lamella and posterior margin concave, membranous.

Setae golden on frons, concealing integument ventrolaterally; appressed on upper frons, postocellar area, and scutum; on propodeal dorsum appressed, oriented anterad (integument glabrous along midline, broadly so at apex).

Head black except clypeus pale yellow, mandibles pale yellow basally (apex dark reddish to black), scape pale yellow coalescent mesally in some specimens), flagellum yellowish red or reddish brown. Pronotum reddish brown, collar with pair of pale yellow spots, lobe pale yellow posteriorly in female. Mesothorax varying from largely reddish brown (only anterolateral corner of scutum, mesopleuron posteroventrally, and venter black) to largely black. Metanotum either reddish brown or black. Propodeum varying from largely reddish brown to largely black. Legs reddish brown, midfemur darkened ventrally in some specimens, hindfemur darkened basally (also ventrally in some specimens). Tergum I reddish brown, with wide pale yellow band apically, terga II and III black (tergum III with yellow apical fascia in some specimens), terga IV and V reddish brown (at last tergum IV with pale yellow spot) to largely pale yellow.

♀.— Orbital fovea ill defined or absent. Dorsal length of flagellomere I about 1.3 × apical width, that of flagellomere II 1.4 × apical width; greatest length of flagellomere IX equal to 0.8 × apical width, of flagellomere X 2.1 × basal width. Forebasitarsus with seven or eight rake spines. Setae of pygidial plate not concealing integument basally. Length 10.5–11.0 mm.

♂.— Clypeal lamella without lateral teeth (Fig. 71b, d). Flagellomeres III and IV slightly convex ventrally. Dorsal length of flagellomere I about 1.3 × apical width, that of flagellomere II 1.2 × apical width; greatest length of flagellomere IX equal to 0.7 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with six rake spines. Sternum VIII: Fig. 72a. Genitalia: Fig. 72b. Length 7.5 mm.

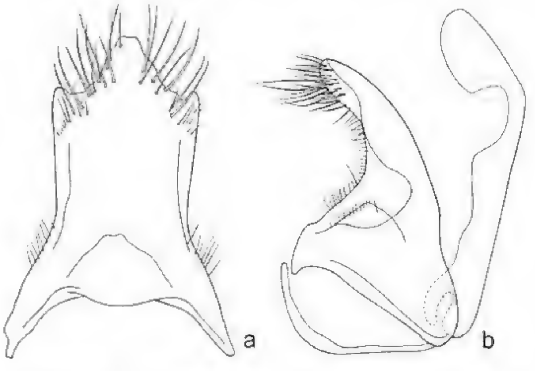

FIGURE 72. *Sericophorus flavofasciatus* (Turner): a – male sternum VIII; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 70).— Queensland.

RECORDS.— AUSTRALIA: Queensland: Brisbane, 14 Nov 1912 (1 ♂, BMNH, holotype of *Zoyphium flavofasciatum*) and Nov 1914 (1 ♀, QMB, labeled as allotype but not part of the type material); 5 km SW Mareeba, 1 Apr 1987 (1 ♀, CAS); Moreton at 12°27'S 142°38'E, 27 July 1992 (1 ♀, ANIC); 3.5 km SSW Mount Blairdat at 15°10'S 145°07'E, 3–5 May 1981 (1 ♀, ANIC).

***Sericophorus flavorufoniger* Pulawski, sp. nov.**
Figures 70, 73, 74.

Derivation of name.— *Flavorufoniger* is a combination of three Latin adjectives: *flavus*, yellow, *rufus*, red, and *niger*, black; with reference to this species coloration.

Recognition.— *Sericophorus flavorufoniger* is easily recognizable by its unique coloration: the scutum (all or largely), scutellum, metanotum, mesopleuron (all or largely), and female propodeum are reddish brown, whereas the clypeus, mesothoracic venter, and gaster are black, and the pronotum is black anteriorly, reddish brown laterally, with a pale yellow collar (Fig. 73a). In the female, the antenna, forecoxa, and all trochanters are pale yellow.

Description.— Frontal punctures nearly contiguous; frontal line shiny, not extending into frons upper half. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to about 0.8 × hindocellar width. Clypeal lamella slightly arcuate (Fig. 73b, c). Scutal punctures less than one diameter apart; interspaces unsculptured or nearly so; scutal flange ending abruptly. Mesopleural punctures about one diameter apart near center; interspaces nearly unsculptured. Propodeal dorsum foveolate along basal margin, with median impression, with median carina from which smaller, oblique carinae emerge; remaining surface punctate and finely, irregularly ridged; side unsculptured; posterior surface finely punctate and finely, transversely ridged except for median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell triangular. Horizontal area of tergum I with punctures that average about one diameter apart; apical depression punctate except near very margin.

Setae silvery, not obscuring integument on frons and clypeus; appressed on upper frons, postocellar area, and scutum; nearly appressed, oriented anterad on propodeal dorsum.

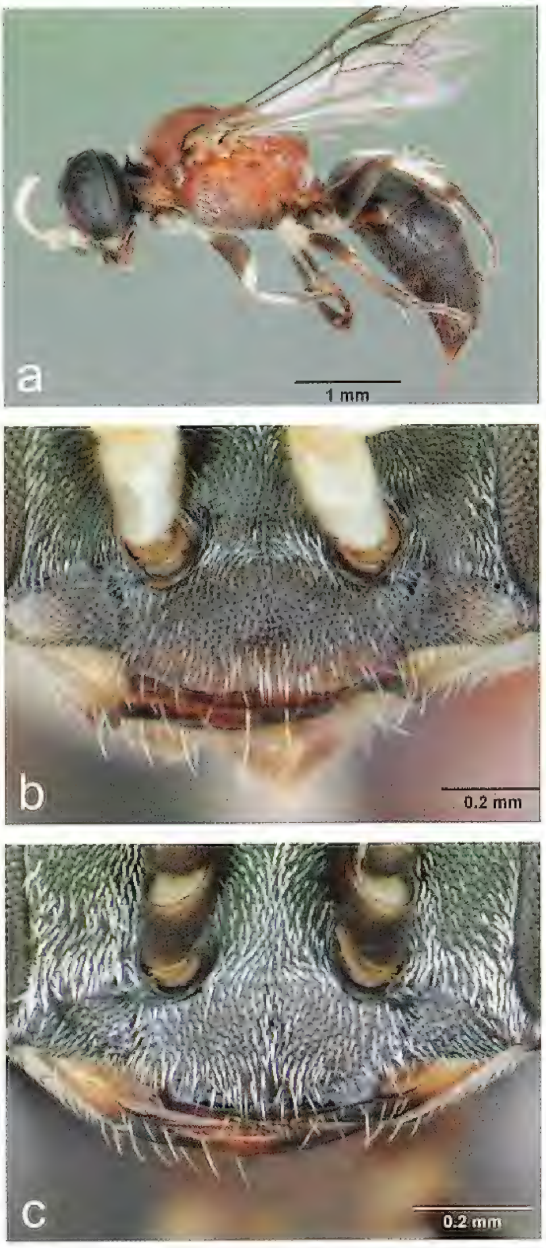

FIGURE 73. *Sericophorus flavorufoniger* Pulawski, sp. nov.: a – female body in lateral view; b – female clypeus in frontal view; c – male clypeus in frontal view.

Head black, but mandible pale yellow basally in most specimens (all black in some females), female antenna pale yellow (flagellum darkened on lateral surface), and male flagellomeres III-X pale yellow ventrally (narrowly so on more basal flagellomeres, widely so on distant flagello-

meres). Thorax and propodeum reddish brown except the following: pronotum black anteriorly, pale yellow on collar, reddish brown laterally; mesothoracic venter black, in male also preepisternal area and propodeal dorsum black. Forecoxa pale yellow, also apical portion of mid- and hindcoxae and all trochanters in female; fore- and midfemora black except pale yellow apically and apicoventrally (midfemur only apically so in male), hindfemur black; foretibia with at least outer surface pale yellow; midtibia black or with inconspicuous pale yellow spot basally; hindtibia black with pale yellow dorsum (all black apically); tarsi dark. Gaster black.

♀.— Orbital fovea ill defined, narrow but broader than half ocellocular distance. Dorsal length of flagellomere I about 1.2 × apical width, that of flagellomere II 1.1 × apical width; greatest length of flagellomere IX equal to 1.0 × apical width, of flagellomere X 1.6 × basal width. Clypeal lamella with one, nonprominent lateral tooth (Fig. 73b). Forebasitarsus with five rake spines. Setae of pygidial plate not obscuring integument. Length 4.0–5.2 mm.

♂.— Clypeal lamella rounded laterally (Fig. 73c). Dorsal length of flagellomere I about 1.0 × apical width; that of flagellomere II about 1.0 × apical width; greatest length of flagellomere IX 1.0 × apical width, of flagellomere X 1.7 × basal width. Forebasitarsus with three rake spines. Sternum VIII: Fig. 74a. Genitalia: Fig. 74b. Length 4.8 mm.

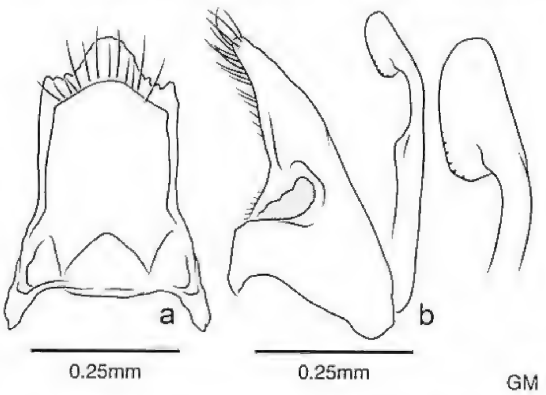

FIGURE 74. *Sericophorus flavorufoniger* Pulawski, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

GEOGRAPHIC DISTRIBUTION (Fig. 70).— Northwestern part of Northern Territory.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Northern Territory**: Gregory National Park at 16°06.6′S 130°27.7′E, 4–12 June 2001, M.E. Irwin, F.D. Parker, and C. Lambkin (ANIC). PARATYPES: **AUSTRALIA: Northern Territory** (collected by M.E. Irwin, F.D. Parker, and C. Lambkin, or as indicated): Gregory National Park at 15°36′43″S 130°24′08″E, 6–12 June 2001 (1 ♀, CAS), 16°06′42″S 130°25′23″E, 24 May–5 June 2001, T. Weir, K. Pullen, P. Bouchard (1 ♀, ANIC), and 16°08.9′S 130°26.6′E, 5–12 June 2001 (1 ♀, USU); Keep River National Park: at 15°45′30″S 129°06′28″E, 6–9 June 2001 (1 ♀, USU), 15°57′33″S 129°01′44″E, 6–9 June 2001 (1 ♀, USU), and 15°57′55″S 129°01′52″E, 3–8 June 2001 (1 ♀, CAS; 1 ♀, USU), also 15°54′55″S 129°04′11″E, 31 May–3 June 2001, T. Weir, K. Pullen, P. Bouchard (1 ♂, USU); 38.5 km SW Timber Creek on Victoria Highway at 15°42′40″S 130°07′48″E, 15–19 June 2001 (1 ♂, CAS).

Sericophorus froggatti Rayment

Figures 75–77.

Sericophorus froggatti Rayment, 1955a:33, ♀. Holotype: ♀, Australia: New South Wales: Mittagong (BCRI), examined by O. Lomholdt.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:247 (in catalog of Australian Sphecidae).

Sericophorus pescotti Rayment, 1955a:39, ♀. Holotype: ♀, Australia: Victoria: Sandringham (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Rayment, 1955a:64 (nesting habits, prey); Bohart and Menke, 1976:302 (listed); Cardale, 1985:248 (in catalog of Australian Sphecidae).

Anacrucis punctuosa Rayment, 1955a:59, ♀. Holotype: ♀, Australia: Western Australia: Nedlands (ANIC), examined by O. Lomholdt and W. Pulawski. **New synonym by W. Pulawski.**— As *Sericophorus punctuosus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:253 (in catalog of Australian Sphecidae).

RECOGNITION.— *Sericophorus froggatti* is one of many species in which the postocellar area

has appressed setae. It shares with *funebris*, *minys*, and the New Guinean *halli* a sharp, sublateral carina on the propodeal dorsum (Fig. 75e), and is further recognized by the clypeal lamella that is inclined in relation to the main clypeal plane (Fig. 75c, d) and the ridged dorsomedian area of the propodeal posterior surface. Unlike *funebris*, the clypeus of *froggatti* has no elevation; unlike *halli*, the posterior mandibular margin is straight between base and notch (rather than convex); and unlike *minys*, the frons is all punctate and setose (rather than unsculptured and glabrous above each antennal scrobe), the propodeal dorsum is punctate and ridged (rather than rugose), the dorsomedian area

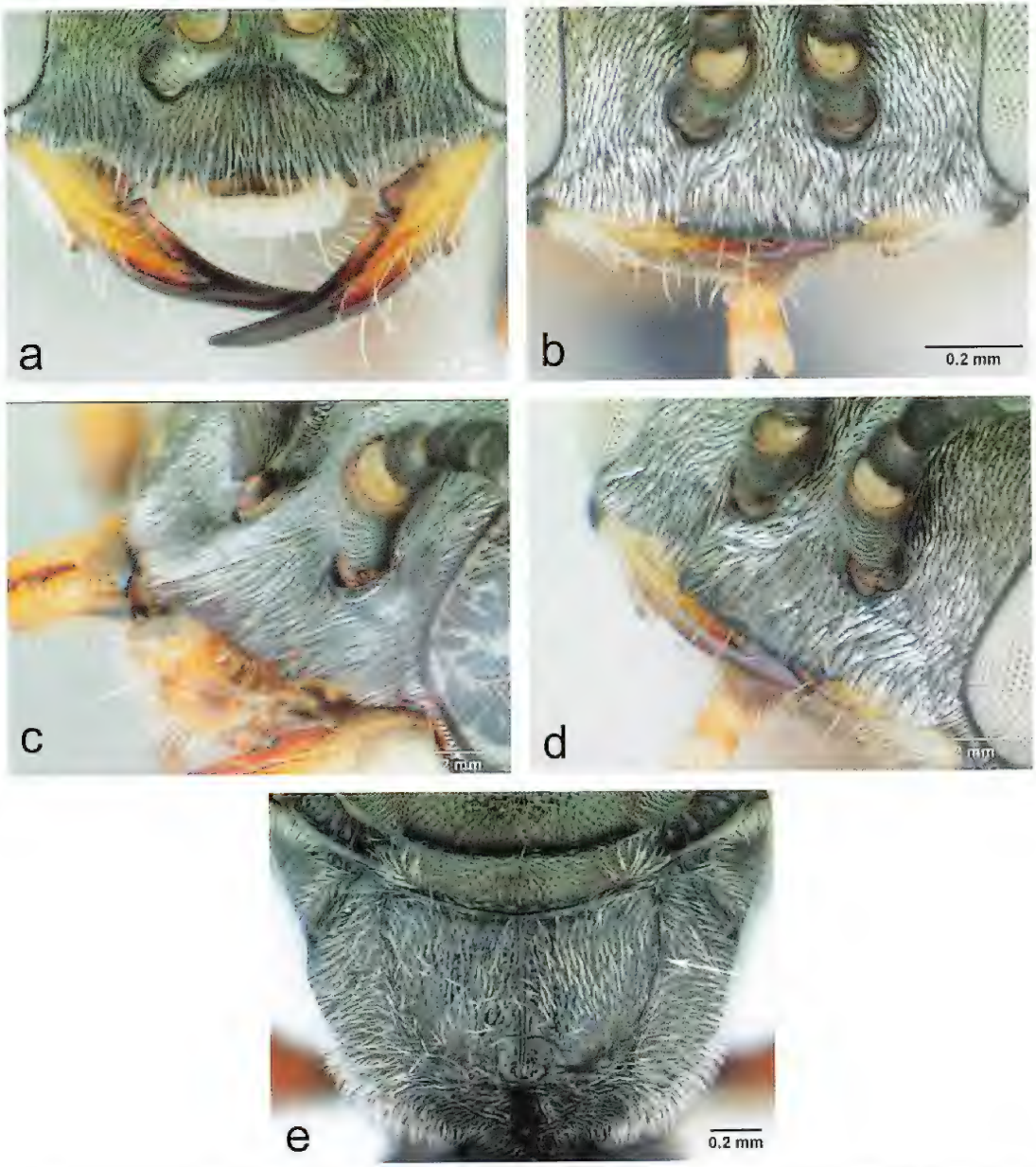

FIGURE 75. *Sericophorus froggatti* Rayment: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female clypeus in oblique lateral view; d – male clypeus in oblique lateral view; e – propodeal dorsum (arrow indicates sublateral carina).

of the posterior propodeal surface is rugose (rather than unsculptured), the free margin of the male middle clypeal section has one lateral tooth (rather than two teeth), and the apical rake spine of the male forebasitarsus is slightly shorter than the apical basitarsus width (rather than equal to 1.3 × apical basitarsus width).

Justification of new synonymy.— *Sericophorus froggatti* was described from a female in which the femora are reddish brown and the forefemur has an apical yellow spot, whereas *punctuosus* was described from a female with largely black fore- and midfemora and no apical spots. These characters, however, fully intergrade (e.g., in specimens from northern part of Northern Territory), and consequently I regard these two names as synonyms.

Description.— Frons slightly impressed above antennal socket; frontal punctures minute, less than one diameter apart; frontal line ill-defined or absent. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.0 × hindocellar width. Middle clypeal section narrowly impunctate next to clypeal lamella; lip inclined in relation to main clypeal surface (Fig. 75a-d). Mandibular margin straight between notch and articulation. Scutal punctures less than one diameter apart, interspaces shiny; scutal flange widest apically, ending abruptly. Mesopleural punctures about one diameter apart at center; interspaces unsculptured or faintly sculptured, shiny. Propodeal dorsum with longitudinal carina between dorsum and side; delimited sublaterally by sharp carina (Fig. 75e), punctate or ridged both inside and outside sublateral carinae; with median carina, that extends till apex of dorsum; with oblique carinae emerging from median carina (carinae reduced except basally in many specimens), interspaces between carinae minutely punctate; side shiny, almost unsculptured to partly ridged; posterior surface irregularly carinate except for median sulcus, with rugose dorsomedian area delimited laterally by sharp carina. Forewing vein M diverging from M+Cu basad of cu-a, submarginal cell II triangular or narrowly open anteriorly. Terga shiny, minutely punctate; horizontal area of tergum I with punctures that are about two to three diameters apart (except less than one diameter laterally); apical depression punctate except adjacent to hindmargin (punctures dense laterally, sparse medially.

Setae silvery on frons and clypeus, concealing integument on clypeus (also on lower frons in male) or integument easily visible (specimens from northern part of Northern Territory), appressed on upper frons, postocellar area, and scutum (dark coppery on scutum); on propodeal dorsum appressed, oriented anterad (median sulcus asetose).

Head, thorax, propodeum, and gaster black except the following: antennae dark brown, middle and apical flagellomeres light brown to reddish ventrally; mandible yellow or yellowish red basally (except in two small females from McArthur River, Northern Territory), dark ferruginous apically; and pronotal collar (except mesally) and pronotal lobe posteriorly pale yellow. Legs mainly bright reddish brown, but femora almost black in females from McArthur River; forefemur darkened basally in male; fore- and midfemoral apex with yellowish spot on outer surface (except spot absent in many specimens from northern part of Northern Territory); hindfemur mostly reddish brown but largely black in small female from Magela Creek, Northern Territory; tibiae reddish brown; tarsi dark or foretarsus reddish brown. Gaster black, with grayish pubescence. Female tergum VI reddish brown apically in most specimens, but all black in those from Wonga Beach, Queensland; pygidial spines black to dark ferruginous.

♀.— Clypeal lamella shallowly emarginate mesally (Fig. 75a). Orbital fovea matt, its width more than half ocellocular distance. Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with 7–9 rake spines. Setae of pygidial plate largely concealing integument. Length 4.0–8.0 mm.

♂.— Lateral corner of clypeal lamella acutely angulate (Fig. 75b). Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with five or six rake spines. Sternum VIII: Fig. 76a. Genitalia: Fig. 76b. Length 3.5–7.0 mm.

NESTING HABITS.— Rayment (1955, as *pescotti*) observed females of this species digging in the sand and preying on unspecified small flies.

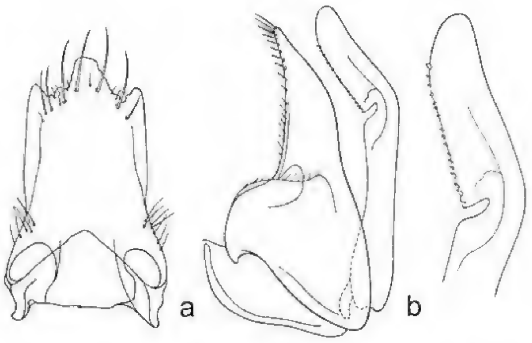

FIGURE 76. *Sericophorus froggatti* Rayment: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

GEOGRAPHIC DISTRIBUTION (Fig 77).— All Australia including Tasmania.

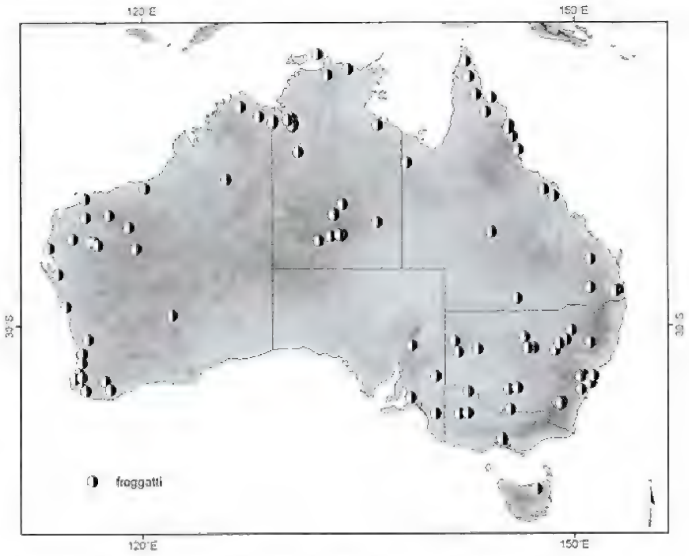

FIGURE 77. Collecting localities of *Sericophorus froggatti*

RECORDS.— **AUSTRALIA**: **Australian Capital Territory**: Canberra, 3 Feb 1980 (1 ♂, ANIC); Black Mountain, 4–17 Feb 1980, Jan 1981, and Mar 1982 (3 ♀, ANIC), 20 Jan–7 Feb 1984 (2 ♀, AEI); Canberra, 10 Feb 1980 (1 ♀, ANIC); Blundells, 6 Jan 1961 (3 ♂, ANIC); Murrumbidgee River near Canberra, 12 Apr 1970 (1 ♀, USNM); Pine Island Reserve 10 mi. S Canberra, 22 Dec 1969 (1 ♂, MCZ). **New South Wales**: 7 km NE Bilpin near Kurrajong, 11 Mar 1981 (1 ♀, AMS); Botany Bay (1 ♀, USNM); 49 km NE Broken Hill at 31°50′S 141°57′E, 3 Dec 1981 (3 ♀, 15 ♂, ANIC); 25 km S Byrock at 30°49′S 146°32′E, 24 Jan 1999 (1 ♀, AMNH); Carrathool, 1920 (2 ♀, ANIC); Como, Dec 1923 (1 ♀, USNM); Cheltenham, 1 Nov 1987 (1 ♂, AMS); 33.8 km N Coonabarabran, 5 Nov 1973 (1 ♀, ANIC); 10 km W Euston, 22 Nov 1975 (1 ♂, ANIC); Fowlers Gap Research Station at 31°05′S 141°42′E, 29 Nov–2 Dec 1981 (5 ♀, 35 ♂, ANIC) and 29 Nov–2 Dec 1981, on *Eucalyptus camaldulensis* (1 ♀, 1 ♂, ANIC); Gilgandra, 1 Nov 1987 (3 ♀, 1 ♂, AMS); S Griffiths at 34°19′S 146°02′E (2 ♀, AMNH); Mittagong, 12 Jan 1902 (1 ♀, BCRI, holotype of *froggatti*; 1 ♀, NMV, incorrectly labeled as paratype by Rayment, not part of original description); Mount Tomah in Blue Mountains, 5 and 18 Feb 1991 (2 ♀, AMS); Myalla Tank, 2 km W Nyngan, 12 Dec 1976, on *Eucalyptus* sp. (3 ♂, UQIC); 25 mi. W Nyngan, 3 Nov 1969 (1 ♀, 4 ♂, MCZ); 23 km SE Tamworth, 25 Nov 1982 (1 ♂, ANIC); Tocumwal, 24 Jan 1989 (2 ♂, AMS); Warrenburg National Park, 20 Dec 1987 (1 ♂, UCD); Warrumbungle National Park at 31°16′S 148°57′E, 17 Dec 1995 (4 ♀, 1 ♂, ZMHU); 10 km SW Wilcannia, 19 Dec 1988 (1 ♂, CAS); Woy Woy, Feb 1933 (1 ♀, BMNH). **Northern Territory**: Alice Springs at 23°41′S 133°52′E, 6 Nov 1988 (1 ♀, 1 ♂, ANIC); 32 km WNW Alice Springs at 23°36′S 133°35′E, 8 Oct 1978 (1 ♀, ANIC); Areyonga, 5 Dec (1 ♀, AEI); Barrow Creek, 8–9 Nov 1974, on *Eucalyptus camaldulensis* (2 ♀, UQIC); Gregory National Park: at 16°06.7′S 130°25.4′E (1 ♀, USU), at 15°36′43″S 130°24′08″E, 14 May–20 June 2001 (1 ♀, 1 ♂, CAS; 2 ♂, USU), 6–12 June 2001 (1 ♂, CAS; 4 ♀, USU), 12–16 June 2001 (11 ♀, USU), and 15–18 June 2001 (1 ♀, CAS), at 15°42′40″S 130°07′48″E, 14 May–20 June 2001 (2 ♂,

CAS; 3 ♂, USU), at 15°58′17″S 130°29′17″E, 12–15 June 2001 (1 ♀, USU), at 16°02′26″S 130°27′18″E (1 ♀, USU), at 16°06.7′S 130°25.4′E, 14 May–20 June 2001 (1 ♀, CAS; 12 ♀, USU), at 16°06′35″S 130°25′39″E, 12 June 2001 (1 ♀, USU), at 16°06′42″S 130°25′23″E, 24 Mar–4 June 2001 (1 ♀, USU), at 16°06.6′S 130°25.7′E, 4–12 June 2001 (2 ♀, USU), and at 16°09′45″S 130°26′31″E, 24 May–5 June 2001 (1 ♀, USU); 65 km S Kalkarindji at 17°55.9′S 130°49.7′E, 11–17 June 2003, (2 ♂, ANIC; 1 ♀, CAS; 1 ♂, USU); Keep River National Park: at 15°44′17″S 129°06′55″E, 8–9 June 2001 (1 ♀, USU), at 15°47′49″S 129°06′31″E, 14 May–20 June 2001 (4 ♀, USU) and 31 May–3 June 2001 (2 ♀, 2 ♂, USU), at 15°54′55″S 129°04′11″E, 1–3 June 2001 (1 ♀, USU), at 15°57′33″S 129°01′44″E, 14 May–20 June 2001 (5 ♀, USU), 3–8 June 2001 (2 ♀, 1 ♂, USU), 10–20 June 2001 (1 ♀, 1 ♂, USU), 31 May–3 June 2001 (6 ♀, USU), 1 June 2001 (1 ♀, USU), 5–9 June 2001 (1 ♀, USU), and 11–20 June 2001 (1 ♀, USU), at 15°45′30″S 129°06′28″E, 14 May–20 June 2001 (3 ♀, USU) and 6 June–6 Sept 2001 (1 ♀, CAS; 2 ♀, USU), at 15°57′36″S 129°01′38″E, 1–3 June 2001 (1 ♀, CAS), and at 16°06′35″S 130°25′39″E, 12 June 2001 (1 ♀, USU); Magela Creek 2 km N Mudginbarry Homestead at 12°35′S 132°52′E, 14–15 Nov 1972 (1 ♀, ANIC); Maningrida, 18 Mar 1961 (1 ♀, BISH); McArthur River 2 km SSE Borroloola at 16°05′S 136°19′E, 20 Apr 1976 (3 ♀, ANIC); Plenty Highway 268 km ENE Alice Springs at 22°47′S 136°18′E, 14 Oct 1987 (1 ♀, ANIC); Roe Creek 12 km WSW Alice Springs at 23°46′S 133°47′E, 9 Oct 1978 (1 ♀, ANIC); Smith Point in Cobourg Peninsula at 11°10′S 132°10′E, 12 Aug 1987 (1 ♀, ANIC) ; Ti-Tree, 7 Nov 1974, on *Eucalyptus camaldulensis* (1 ♀, UQIC); 7 mi. S Ti-Tree Well, 28 Oct 1962 (2 ♀, 4 ♂, CAS); Todd River 9 km NE Alice Springs at 23°38′S 133°53′E, 10 Oct 1978 (1 ♂, ANIC); Victoria Highway 38.5 km SW Timber Creek at 15°42′40″S 130°07′48″E, 14 May–20 June 2001 (1 ♀, CAS; 3 ♂, USU), 31 May–3 June 2001 (1 ♀, CAS), 6–13 June 2001 (1 ♀, 2 ♂, CAS; 20 ♀, 6 ♂, USU), 13–19 June 2001 (3 ♀, USU), and 15–19 June 2001 (1 ♂, CAS); West McDonnell National Park: Ellery Creek Big Hole at 23°46.7′S 133°04.4′E, 4 Nov 1979 (1 ♀, ANIC), 6 Mar 2008 (1 ♀, CAS), 12 Mar 2008 (1 ♀, CAS), and Simpsons Gap at 23°40.7′S 133°43.1′E, 5 Mar 2008 (2 ♀, 2 ♀). **Queensland**: 7 km S Batavia Downs at 12°43′S 142°42′E, 23 Nov–11 Dec 1992 (1 ♀, ANIC); Brisbane, 12 Feb 1912, 15 Nov 1916 and 22 Jan 1956 (5 ♀, BMNH, QMB and NMV), 8 Feb 1916 (1 ♀, QMB, paratype of *pescotti*), 23 Mar 1919 (1 ♂, BISH); Cape Tribulation National Park: Noah Beach, 18 Dec 1988 (2 ♀, USNM); Cockatoo Creek crossing 17 km NW Heathlands at 11°39′S 142°27′E, 26 Jan–29 Feb 1992 (1 ♂, ANIC); Coen at 13°57′S 143°12′E, 13 Jan–25 Feb 1994 (1 ♀, ANIC); Collinsville, 15 Sept 1950 (1 ♂, ANIC); Eidsvold at 25°22′S 151°07′E, 11 Oct 1984 (1 ♀, ANIC); Eungella National Park 80 km NW Mackay, 16–19 Oct 1979 (1 ♀, UQIC); Flinders Island, Jan 1927 (1 ♀, SAM); Gilruth Plains, 12 Dec 1963 (1 ♀, ANIC); Hann River at 15°11′S 143°52′E, 20 Mar–24 Apr 1994 (1 ♀, ANIC); Kamerunga 10 mi. N Cairns, 8–9 Nov 1972 (9 ♀, 2 ♂, FSCA); Kurrimine Beach 30 km S Innisfail at 17°46.6′S 146°06.5′E, 16 May 2007 (2 ♀, CAS); Lake Broadwater 30 km SW Dalby, 23 Nov 1985 (8 ♀, QMB); Longreach, 23 Oct 1968 (1 ♀, UQIC); Mid Queensland (1 ♀, BMNH); Moggill Farm W Brisbane, 27 Jan–1 Feb 1961 (1 ♀, BISH); Narrabri, 24 Jan 1961 (1 ♀, UCD); Ridgpole Waterhole 24 km ESE Musselbrook Resource Centre in Lawn Hill National Park at 18°40′15″S 138°22′15″E (1 ♀, UQIC); Wonga Beach 11 km NEE Mossman at 16°19.9′S 145°25.3′E, 19–22 Nov 2006 (9 ♀, 2 ♂, CAS). **South Australia**: Adelaide, 10–17 Dec 1981 (1 ♂, UCD); Belair, 15 Jan 1962 (2 ♂, SAM); Keirk, 24 Jan 1963 (1 ♀, SAM); Keith, 10 Feb 1983 (5 ♀, UCD); Oraparinna Creek at 31°21′S 138°42′E, 4–10 Nov 1987 (1 ♀, 1 ♂, ANIC); 79 km NNW Renmark at 33°31′S 140°24′E, 8 Nov–12 Dec 1995 (2 ♀, ANIC). **Tasmania**: Barrow Creek 8 km NE Nunamara at 41°21′S 147°22′E, 7 Dec 1981 (1 ♀, ANIC). **Victoria**: 5–15 mi. S Rainbow, 21–22 Feb 1970 (1 ♀, MCZ); Sandringham (1 ♀, BMNH), 21 Feb 1950 (1 ♀, NMV, holotype of *pescotti*); South Yarra, 18 Mar 1949 (1 ♀, NMV); Wilkur, 26 Feb 1955 (1 ♀, NMV). **Western Australia**: Bunbury, Jan 1961 (1 ♀, AMS); 18 mi. S Bunbury in Capel District, 7 Jan 1957 (1 ♀, AMS); Busselton, 2 Apr 1954 (2 ♀, ANIC), 14 Dec 1972 (1 ♀, WAMP); 48 km NW Carnarvon on Blowholes Road at 24°35.2′S 113°31.2′E, 27 Apr–11 May 2003 (1 ♀, ANIC); Carson Escarpment at 14°49′S 126°49′E, 9–15 Aug 1975 (1 ♀, ANIC); 22 km E Cobra Station at 24°35.2′S 113°31.2′E [correctly: 22°10′S 116°40′E], 27 Apr–11 May 2003 (1 ♀, ANIC); 10 km W Cobra Station at 24°10.2′S 116°23.0′E, 21 Apr–10 May 2003 (1 ♀, CAS) and 26 Apr–10 May 2003 (5 ♀, ANIC; 1 ♂, CAS); Cottesloe (Perth), 24 Feb 1983 (1 ♀, WAMP); Donelly River Crossing on Pemberton/Nannup Road, 24 Dec 1966, on *Eucalyptus* sp. (2 ♂, UQIC); Donnybrook, Jan 1956 (1 ♂, NMV); 11 km NE Geraldton, 31 Dec 1975, on *Eucalyptus* (1 ♀, UQIC); Hamelin Telegraph Station at 26°23.9′S 114°09.9′E, 8 Nov 2008 (1 ♀, 1 ♂, CAS); 82 km S junction of Karijini Drive on Great Northern Highway at 23°07.3′S 119°05.5′E

(1 ♀, ANIC); 12 mi. SW Katanning, 7 Feb 1973, on *Eucalyptus calophylla* (1 ♂, UQIC); Kennedy Range National Park at 23°56.8′S 115°10.4′E, 26 Apr–10 May 2003 (5 ♀, 3 ♂, ANIC; 6 ♀, 3 ♂, USU); 28 km E Mardie Station at 21°11.3′S 115°58.5′E, 21–23 May 2003 (1 ♂, ANIC); Mining Camp in Mitchell Plateau at 19°49′S 125°50′E, 1–19 May 1983 (2 ♀, ANIC); Mount Augustus National Park at 24°22.8′S 116°54.2′E, 15 May 2003 (1 ♀, CAS); Mussel Pool 7.5 km NW Midland, 24 Nov 1975 (1 ♀, WAMP); 65 km E Nanutarra Roadhouse at 22°27.8′S 116°02.6′E, 5–12 May 2003 (1 ♀, 1 ♂, ANIC); Nedlands, 1 Dec 1946 (1 ♀, ANIC, holotype of *Anacrucis punctuosa*, head missing); 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003 (1 ♀, ANIC; 1 ♀, CAS; 1 ♀, USU); near New Norcia, 16 Mar 1962 (1 ♀, WAMP); 80 km S Pardoo Roadhouse at 20°28.3′S 120°10.0′E, 15 Jan–14 May 2003 (1 ♀, CAS); Perth, 2–4 Nov 1935 (1 ♀, BMNH); Stirling Range National Park at 34°25.3′S 117°47.2′E, 7 Dec 2008 (1 ♂, CAS); 60 km N Tom Price on Hamersly Iron Road at 22°18.8′S 117°40.5′E, 20 Apr 2003 (3 ♀, 1 ♂, ANIC; 2 ♂, CAS); Warren River 6 mi. SE Pemberton, 16 Jan 1971 (1 ♀, AMS); Wyndham, 27 Jan 1953 (1 ♂, AMS); York, 23 Jan 1973, on *Schinus molle* (1 ♀, UQIC); Yundamindra Homestead at 29°15′S 122°06′E, 16 Mar 1979 (1 ♂, WAMP); Yunderup, 2 Dec 1984 (1 ♀, 2 ♂, WAMP).

Sericophorus frontalis (Turner)

Figures 78, 79.

Zoyphium frontale Turner, 1908:496, ♀. Holotype: ♀, Australia: Queensland: Mackay (BMNH), examined by O. Lomholdt.— Turner, 1914:358 (in revision of Australian *Zoyphium*).— As *Sericophorus frontalis*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:252 (in catalog of Australian Sphecidae).

Recognition.— The female of *Sericophorus frontalis* is unusual in having the lower half to two thirds of the frons yellow (Fig. 78a, b), at least mesally, and only two submarginal cells (Fig. 78d). The male is unknown. Only two submarginal cells are also present in *bicellularis*, but unlike that species the second submarginal cell of *frontalis* is wide (the length of its radial margin is about equal to the maximum height), whereas it is narrow in *frontalis* (the length of the radial margin is markedly less than the height). Additionally, the thorax and propodeum of *frontalis* are largely reddish brown (black in *bicellularis*), and the forewing membrane is uniformly transparent (with dark spot apically in *bicellularis*, although the spot is faint in the male).

Description.— Frontal punctures almost contiguous; frontal line present. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.8 × hindocellar width. Middle clypeal section wide, clypeal lamella slightly arcuate (Fig. 78c). Most scutal punctures less than one diameter apart; scutal flange ending abruptly. Mesopleural punctures more than one diameter apart below scrobe. Propodeal dorsum finely, obliquely ridged, punctate between ridges, with median sulcus that contains median carina (carina almost reaching posterior surface); side sparsely punctate dorsally, impunctate ventrally; posterior surface punctate except for median sulcus. Forewing with two submarginal cells (Fig. 78d), second widely open anteriorly (length of radial margin about equal to maximum height); reduction in submarginal cell number apparently achieved through reduction of vein 1r-m (trace of 1r-m present in right wing of holotype); vein M diverging from M+Cu basad of cu-a (minimally so in specimen from Kuranda). Gaster almost polished, minutely punctate; horizontal area of tergum I with punctures that are several diameters apart.

Setae silvery, evanescent, sparse on frons; appressed on upper frons, postocellar area, and scutum; on propodeal dorsum appressed, inconspicuous, oriented obliquely anterad (integument glabrous mesally, broadly so near apex).

Lower half to two thirds of frons and all clypeus yellow except area between antennal socket and orbit black in specimen from Brisbane (Fig. 78a, b). Mandible yellow, reddish apically. Anten-

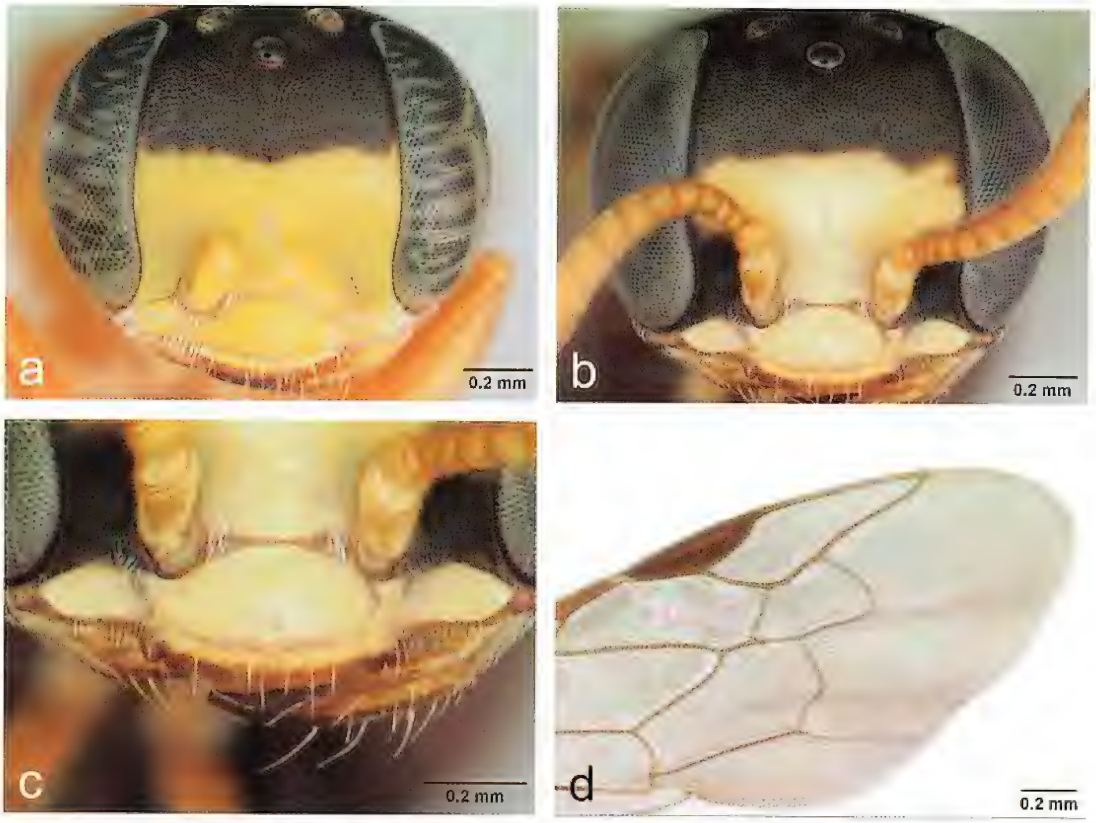

FIGURE 78. *Sericophorus frontalis* (Turner): a – head of a female from Kuranda in frontal view; b – head of a female from Mackay in frontal view; c – clypeus of a female from Mackay in frontal view; d – apical portion of female forewing.

na yellow, flagellum reddish apically. Thorax and propodeum all reddish brown in specimen from Kuranda, in that from Brisbane scutum largely blackish (reddish brown laterally) and mesothoracic venter black, in holotype pronotum mainly reddish, scutum brown (reddish laterally and along posterior margin), metanotum reddish, and mesopleuron brown. Legs yellowish reddish. Gaster black.

♀.— Orbital fovea absent. Dorsal length of flagellomere I 1.0 × apical width; of flagellomere II 0.6 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X

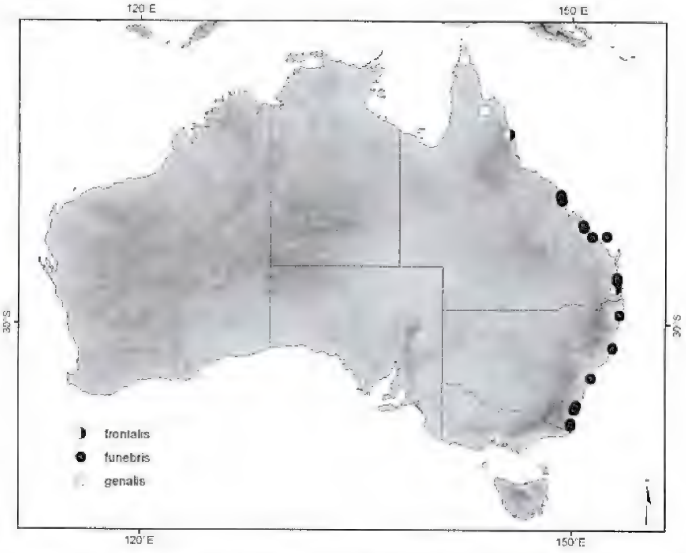

FIGURE 79. Collecting localities of *Sericophorus frontalis*, *funebris*, and *genalis*.

1.6 × basal width. Forebasitarsus with five rake spines. Pygidial plate reddish apically, with setae that do not conceal integument basally and nearly conceal it apically. Length 5.1–5.4 mm.

♂.— Unknown.

Geographic distribution (Fig. 79).— Queensland.

Records.— AUSTRALIA: Queensland: Brisbane, July–November, year not indicated (1 ♀, AEI); Kuranda: Russet Park, 13 Oct 1987 (1 ♀, CAS); Mackay, Mar 1900 (1 ♀, BMNH, holotype of *Zoyphium frontale*).

Sericophorus funebris Turner

Figures 79–81.

Sericophorus funebris Turner, 1907:276, ♀. Lectotype: ♀, Australia: Queensland: Mackay (BMNH), **present designation by O. Lomholdt**, examined by O. Lomholdt.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:247 (in catalog of Australian Sphecidae).— As *Zoyphium funebre*: Turner, 1912:60 (new combination, as *funebris*), 1914c:355 (in revision of Australian *Zoyphium*).

Zoyphium humile Cockerell, 1932:117, ♀. Holotype: ♀: Australia: Queensland: Bribie Island (QMB), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— As *Sericophorus humilis*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:253 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus funebris* is the only species of the genus in which the sublateral carina on the propodeal dorsum is combined with an elevated middle clypeal section, the ventral portion of the elevation being glabrous, concave (Fig. 80a-f). The presence of erect setae on the interocellar area is a subsidiary recognition feature.

Description.— Frontal punctures minute, ill defined, about one diameter apart; frontal line shiny, well defined. Orbital fovea present in both sexes, somewhat ill defined, almost as wide as ocellocular distance. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.8 × hindocellar width. Clypeus: see below. Scutum with shallow punctures that average about one diameter apart; scutal flange widest apically, ending abruptly. Mesopleural punctures minute. Propodeal dorsum microsculptured and with evanescent microscopic punctures, delimited by carina both sublaterally and posteriorly, carina partly replaced by irregular ridges in smaller specimens; median longitudinal carina well defined, median depression well defined only posteriorly; dorsum and side separated by carina that starts at posterior margin of spiracle but is replaced by several small ridges posteriorly; side and posterior surface separated by carina except dorsally; side unsculptured or slightly microsculptured anteriorly; posterior surface minutely punctate (except for median sulcus), with triangular dorsomedian area rugose, delimited by carina. Forewing vein M diverging from M+Cu basad of cu-a (almost contiguous in some specimens); second submarginal cell triangular or nearly so. Terga minutely punctate; horizontal area of tergum I with punctures that are several diameters apart (impunctate along posterior margin); sternum I with two well-defined ridges that are nearly confluent anteriorly.

Setae of lower frons and clypeus silvery, concealing integument; on interocellar area erect, slightly shorter than midocellar width; on postocellar area suberect, markedly shorter than midocellar width; on scutum suberect, markedly shorter than midocellar width; on propodeal dorsum suberect, oriented anterad (median sulcus asetose).

Antennae black, apical flagellomeres reddish brown ventrally. Mandibles yellowish white, apex ferruginous. Thorax and propodeum all black (some females and most males), or pronotal collar with a pair of pale yellow lateral spots and pronotal lobe pale yellow apically (most females, some males). Femora black, narrowly reddish brown apically; foretibia and foretarsus reddish brown to yellowish brown, mid- and hindtibiae and tarsi ferruginous, tibiae largely darkened in

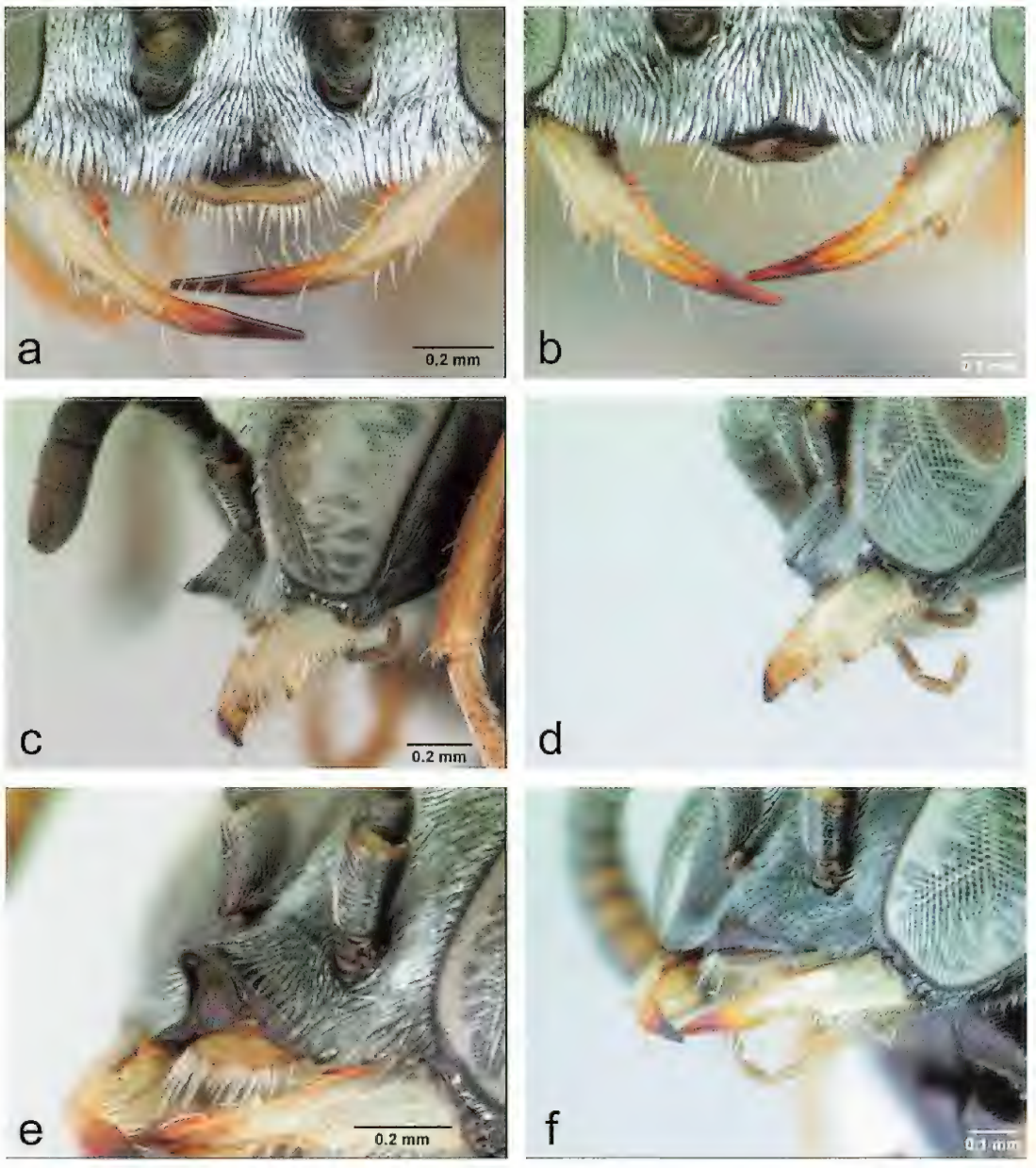

FIGURE 80. *Sericophorus funebris* Turner: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female clypeus in lateral view; d – male clypeus in lateral view; e – female clypeus in lateral oblique view; f – male clypeus in lateral oblique view.

most specimens, and part of tarsi in some. Gaster black; female tergum VI black.

♀.— Clypeal middle lobe with markedly raised elevation that narrows toward apex and is emarginate apically in largest specimens; ventral face of elevation glabrous, deeply concave (Fig. 80a, c, e); clypeal lamella deeply emarginate mesally, with only one lateral tooth (edentate in some specimens). Dorsal length of flagellomere I 1.0 × apical width; of flagellomere II 0.6 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.3 × basal width.

Forebasitarsus with five or six rake spines. Setae of pygidial plate not concealing integument. Length 3.9–7.5 mm.

♂.— Clypeal middle lobe elevated anteriorly, ventral (= anterior) portion of elevation glabrous, triangular, concave (Fig. 90b, d, f); lamella with ill-defined lateral tooth. Dorsal length of flagellomere I 0.7 × apical width; of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with five rake spines (exceptionally six). Sternum VIII: Fig. 81a. Genitalia: Fig. 81b. Length 3.5–5.5 mm.

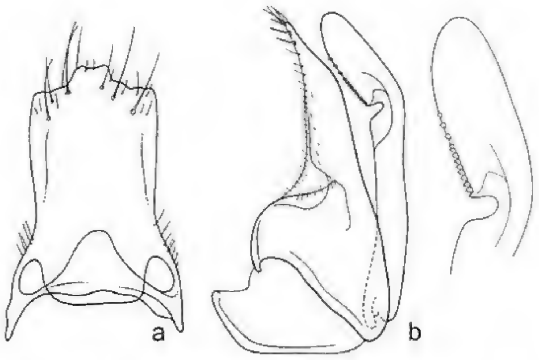

FIGURE 81. *Sericophorus funebris* Turner: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

HABITAT.— Specimens from Armstrong Beach, Blacks Beach, Durras, Keppel Sands, and Tannum Sands were collected on inclined surfaces of sand dunes facing the oceanic beaches, only a few dozen meters away from the ocean waters. Presumably the species is limited to such habitats.

GEOGRAPHIC DISTRIBUTION (Fig. 79).— Coastal areas of Queensland and New South Wales.

RECORDS.— **AUSTRALIA**: **New South Wales**: Broulee, 9 Feb 1963 and 23 Dec 1969 (17 ♀, 10 ♂, ANIC, MCZ); Congo 8 km ESE Moruya at 35°58′S 150°09′E, 18 Dec 1981, 12–19 Feb 1982, window traps (40 ♀, 10 ♂, ANIC); Dee Why, 24 Feb 1957 (1 ♀, 4 ♂, USNM); Dunbogan, on ocean beach vegetation, 17 Nov 1985 (1 ♀, ANIC); Eden, 27 Jan 1963 (1 ♂, ANIC); Durras at 35°40′S 150°17′E NE Batemans Bay, 18 Mar 2001 (1 ♀, ZMHU); 5 km W Iluka Beach, 22 Jan 1978 (1 ♀, CAS); Merimbula, 14 Jan 1960 (1 ♀, ANIC); 2 km N North Haven, 12 Jan 1978 (3 ♀, CAS). **Queensland**: Armstrong Beach ca 15 km E Sarina at 21°27.3′S 149°17.5′E, 29 Oct 2006 (3 ♀, 2 ♂, CAS); Blacks Beach ca 8 km N Mackay at 21°03.6′N 149°11.7′E, 30 Oct 2006 (7 ♀, 1 ♂, CAS) and 21°02.8′S 149°11.3′E, 30 Oct 2006 (1 ♀, 1 ♂, CAS); Bribie Island, Nov 1918 (1 ♀, QMB, holotype of *Zoyphium humile*); Caloundra: King's Beach, July 1955 (3 ♀, 1 ♂, ANIC, UQIC); Currimundi Lake Conservation Park adjacent to Caloundra at 26°45.8′S 153°07.7′E, 9 Dec 2006 (1 ♂, CAS); Keppel Sands at 23°19.5′S 150°47.6′E, 28 Oct 2006 (1 ♀, 1 ♂, AMS; 24 ♀, 26 ♂, CAS); Lady Musgrave Island and North West Islands, 1927 (2 ♀, BMNH); Mackay, Oct 1899 (4 ♀, BMNH, lectotype and paralectotypes of *funebris*); Mid Queensland (2 ♂, BMNH); Tannum Sands at 23°56.8′S 151°22.5′E, 7 Dec 2006 (5 ♀, 13 ♂, CAS; 1 ♀, 1 ♂, USU); Yeppoon, 19–22 Dec 1969 and 13 Oct 1979 (4 ♀, 4 ♂, MCZ, UQIC).

Sericophorus genalis Pulawski, sp. nov.

Figures 79, 82–84.

NAME DERIVATION.— *Genalis* is a Latin masculine and feminine adjective derived from gena; with reference to the unusual genal structure of this species.

RECOGNITION.— *Sericophorus genalis* is unique in having the mandible prominently bidentate apically (Fig. 82a, c, f), its inner margin without subbasal teeth, and the lower gena with a conspicuous, irregular projection (Fig. 83). Subsidiary recognition features are: frons with sharp tooth slightly above midheight, clypeus unusually short (distance between its free margin and antennal socket shorter than socket width), and female hindtibia thickened, as thick as the hindfemur.

DESCRIPTION.— Head unusually wide (Fig. 82a, b), length to width ratio about 1.0:1.55 in female, 1.0:1.6 in male (length measured from midpoint of clypeal free margin to top of vertex). Frontal punctures minute, almost compressed against each other. Frons with sharp tooth slightly above midheight (Fig. 82e), frontal line absent. Scapal basin present, slightly longer than width of antennal socket. Antennal socket separated from clypeal free margin by less than socket width.

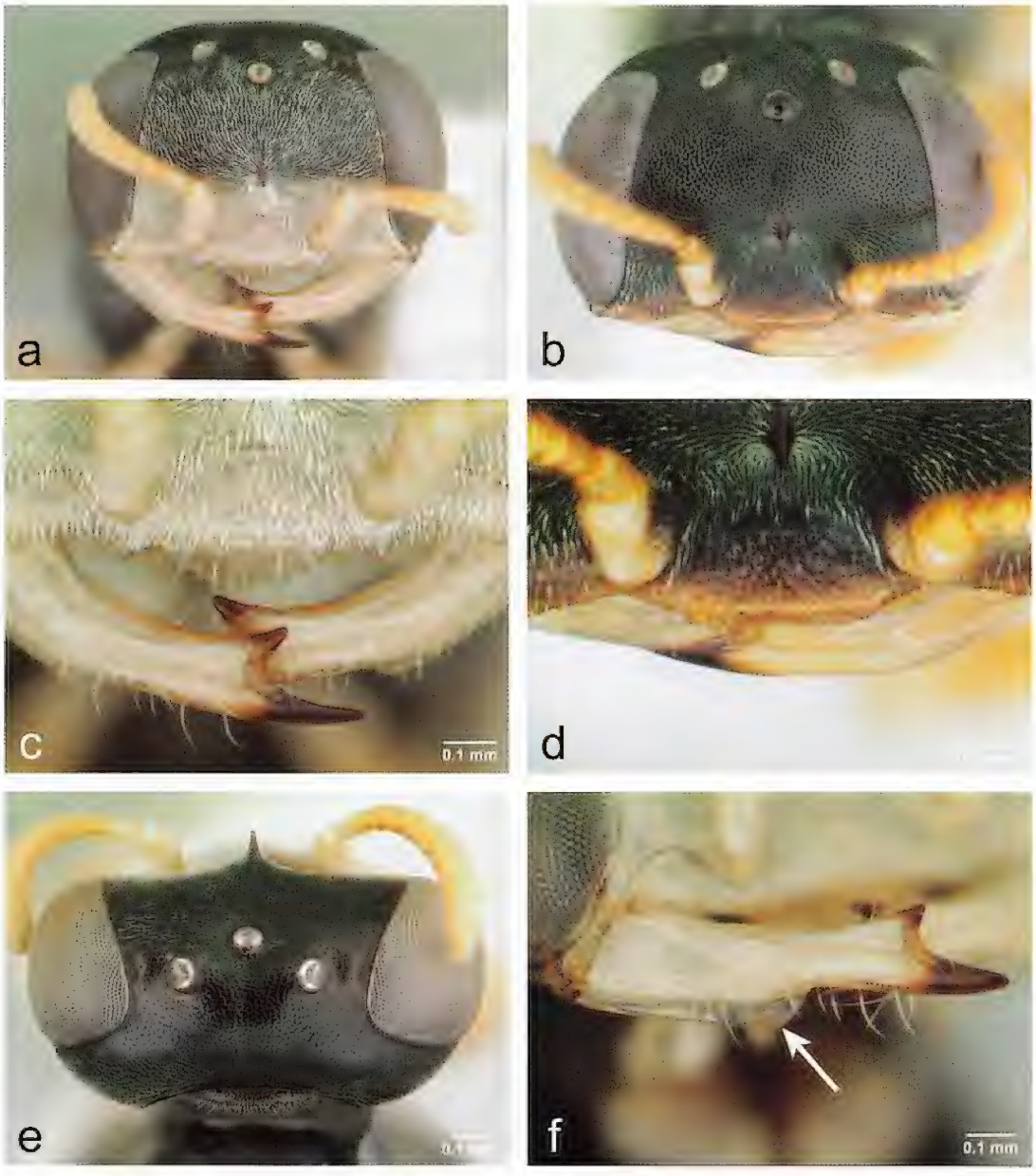

FIGURE 82. *Sericophorus genalis* Pulawski, sp. nov. ♀: a – head in dorsal view; b – head in frontal view; c – middle section of clypeus in frontal view; d – mandible in outer view (arrow indicates rounded ventral mandibular tooth).

Ocellocular distance equal to 1.2 × hindocellar width. Interocellar area convex adjacent to hindocellus, concave mesally. Clypeus unusually short, distance between its free margin and antennal socket shorter than socket width. Lower gena with irregular projection (Fig. 83) whose basis joins hypostomal carina; occipital carina joining projection but not hypostomal carina. Mandible conspicuously bidentate apically, inner margin without subbasal teeth (Fig. 82a, c, f); posteroventral tooth rounded (Fig. 82f). Scutal punctures about 1–2 diameters apart mesally; scutal flange ending abruptly. Mesopleural punctures about one diameter apart; interspaces almost unsculptured.

Propodeal dorsum obliquely ridged, foveolate basally, with median, glabrous sulcus that contains longitudinal carina basally and several transverse carinae mesally and posteriorly; side ridged; posterior surface microsculptured (except mesally). Forewing vein M interstitial with cu-a; second submarginal cell open anteriorly. Tergum I flat basomedially; punctures of horizontal area several diameters apart; apical depression impunctate; apical depression of tergum II impunctate.

Setae of lower frons and clypeus silvery, partly obscuring integument; appressed on upper frons, postocellar area, and scutum; appressed, inconspicuous, oriented anterad on propodeal dorsum.

FIGURE 83. *Sericophorus genalis* Pulawski, sp. nov. ♂: head in lateral view (arrow indicates genal expansion).

Head, thorax, and propodeum black except the following are pale yellow: mandible (tip dark brown), antenna (flagellum brownish yellow dorsally), tegula, female clypeus and lower frons, and male clypeus along free margin. Forecoxa yellow; femora brownish yellow, yellow apically; tibiae and tarsi yellow. Gaster reddish brown.

♀.— Orbital fovea narrower than half ocellocular distance. Clypeal lamella with one, prominent lateral tooth (Fig. 82c). Dorsal length of flagellomere I about 1.0 × apical width, of flagellomere II about 0.8 × apical width; greatest length of flagellomere IX about 0.7 × apical width; greatest length of flagellomere X 1.5 × basal width. Hindtibia thickened, as thick as hindfemur. Forebasitarsus with four or five rake spines. Setae of pygidial plate suberect, not concealing integument. Length 5.2–5.5 mm.

♂.— Free margin of clypeal lobe without lateral teeth (Fig. 82d). Dorsal length of flagellomere I about 1.2 × width, of flagellomere II about 0.8 × apical width; greatest length of flagellomere IX 1.0 × apical width, of flagellomere X 1.75 × basal width. Forebasitarsus with three rake spines: one subbasal, one preapical, and one apical. Sternum VIII: Fig. 84a. Genitalia: Fig. 84b. Length 4.4 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 79).— Known from two localities in northern Queensland.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Queensland**: Hann River at 15°11′S 143°52′E, 17 Nov–18 Dec 1993, P. Zborowski (ANIC). **PARATYPES: AUSTRALIA: Queensland**: same data but 20 Oct–17 Nov 1993, P. Zborowski and M. Horak (1 ♂, ANIC); Cockatoo Creek crossing 17 km NW Heathlands at 11°39′S 142°27′E, 19 Aug–18 Sept 1993, P. Zborowski and L. Miller (1 ♀, CAS).

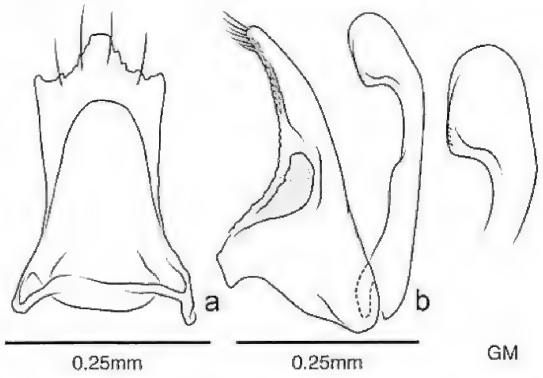

FIGURE 84. *Sericophorus genalis* Pulawski, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

***Sericophorus glaucus* Pulawski, sp. nov.**
Figures 85–87.

Name derivation.— *Glaucus*, from the Greek *γλαυκός*, bluish green; with reference to the body color of this species.

Recognition.— *Sericophorus glaucus* is one of the species with a bluish green thorax, propodeum, gaster, and femora, setae of the postocellar area erect, and tergum I concave basally. It resembles *chalybeus* and *wheeleri* in having the scutellum obtusely swollen medially, with the apex of the swelling black, contrasting with the surrounding area (as in Fig. 34c). It differs from these two species in having the ocellocular distance equal to 0.8 × hindocellar width (rather than 1.3–1.8 × hindocellar width) and a non-dentate laterally male clypeal lamella (rather than bidentate). Unlike *chalybeus*, it has the upper frons black (rather than green), no tubercle on tergum I mesally, and male forefemora (except apically) all bluish green (at least the forefemur is reddish brown in *chalybeus*). Unlike *wheeleri*, female tergum I of *glaucus* is metallic bluish green, and the male flagellum is reddish brown ventrally (in *wheeleri*, tergum I of most females is partly reddish brown, and the male antenna is black).

Description.— Frontal punctures minute, superficial, 2–3 diameters apart. Frontal line broadened near frons midheight, ill defined above and below; interocellar area convex adjacent to hindocellus, concave mesally. Ocellocular distance equal to 0.8 × hindocellar width. Scutal punctures 2–3 diameters apart on disk; scutal flange gradually narrowing posterad; scutellum compressed into obtuse, median swelling, apex of swelling black, prominent. Mesopleural punctures several diameters apart near center. Propodeal dorsum punctate (punctures more than one diameter apart), adjacent to foremargin with deep, crenulate sulcus that extends mesally into well-defined, longitudinal sulcus; the latter crossed by transverse carinae (without median carina); side microsculptured and finely punctate, unsculptured anteriorly; series of conspicuous, transverse carinae present between side and posterior surface; posterior surface minutely punctate except for median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly. Tergum I concave anteriorly, punctures of horizontal area averaging about 1–2 diameters apart; apical depression punctate; apical depression of tergum II punctate except along tergal hindmargin.

Setae of lower frons and clypeus silvery, not obscuring integument; erect on upper frons and postocellar area, on interocellar area about 1.2 × midocellar width; on scutum inclined posterad, up to about 0.6 × midocellar width; oriented anterad on propodeal dorsum.

Clypeus (all or largely) and frons black; postocellar area, gena, thorax, propodeum, gaster,

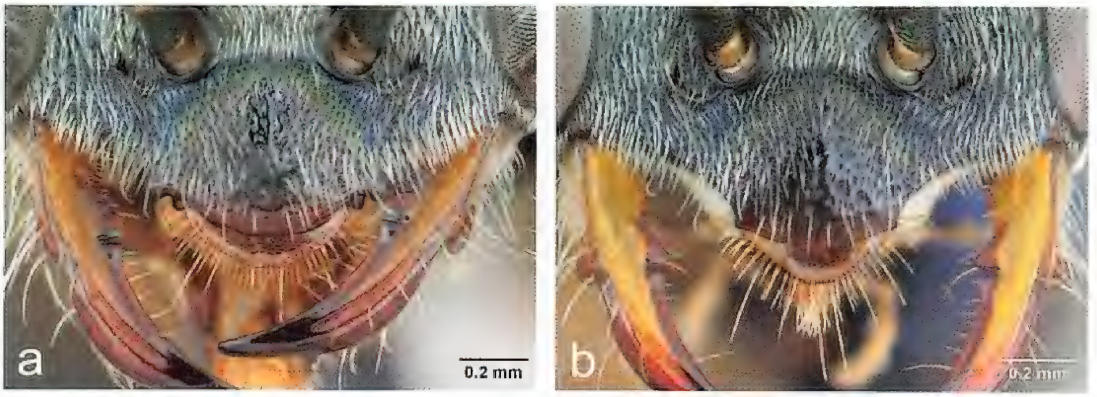

Figure 85. *Sericophorus glaucus* Pulawski, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view.

coxae, and femora bluish green, male tergum VII reddish brown; mandible yellow basally, reddish mesally, black apically; scape and pedicel black, flagellum reddish brown, darkened dorsally in male. Foretibia and tarsus reddish brown, mid- and hindtibiae and tarsi black.

♀.— Orbital fovea ill defined. Clypeal lamella arcuate (Fig. 85a). Dorsal length of flagellomeres I and II 1.4 × apical width; greatest length of flagellomere IX 0.5 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate not concealing integument. Length 7.2–9.0 mm.

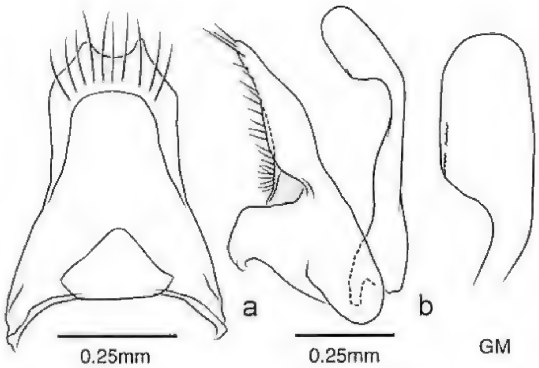

FIGURE 86. *Sericophorus glaucus* Pulawski, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

♂.— Clypeal lamella angulate laterally (Fig. 85b). Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 1.2 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with four or five rake spines. Sternum VIII emarginate apicomesally (Fig.86a). Genitalia: Fig. 86b. Length 4.9–6.1 mm.

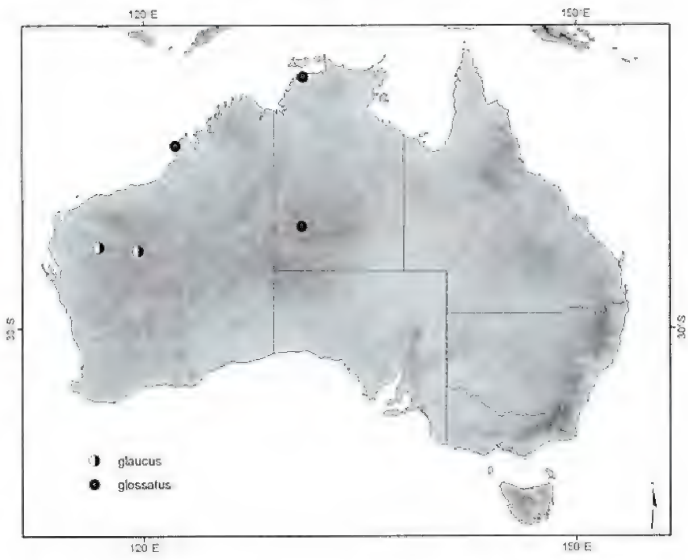

FIGURE 87. Collecting localities of *Sericophorus glaucus* and *glossatus*.

GEOGRAPHIC DISTRIBUTION (Fig. 87).— Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **Western Australia**: 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003, F.D. Parker and M.E. Irwin (ANIC). PARATYPES (all collected by F.D. Parker and M.E. Irwin): **AUSTRALIA**: **Western Australia**: Mount Augustus National Park at 24°21.9′S 116°51.7′E, 25 Apr–7 May 2003 (1 ♀, 1 ♂, ANIC); 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003 (1 ♂, ANIC; 2 ♂, USU), 7–18 May 2003 (2 ♀, 1 ♂, ANIC; 2 ♂, CAS; 3 ♀, USU), 18–21 May 2003 (1 ♂, ANIC; 1 ♂, USU), and 21–23 May 2003 (2 ♀, ANIC; 2 ♀, CAS).

Sericophorus glossatus Lomholdt, sp. nov.

Figures 87–89.

NAME DERIVATION.— *Glossatus*, Latin masculine adjective derived from glossa; with reference to the unusually long glossa of this species.

RECOGNITION.— *Sericophorus glossatus* is unique in having the glossa narrow, about three times as long as the scape and notched in the apical two thirds of its length (Fig. 88c-e). It can also be recognized by a black thorax and propodeum (except for the pale yellow pronotal lobe and male

pronotal collar), forecoxa, and gaster in combination with the pale yellow tibiae (all or predominantly) and clypeus (only narrowly so in the male). The punctate (not ridged) propodeal dorsum is an auxiliary recognition feature.

Description.— Glossa narrow, about three times as long as scape, with mesal emargination extending about two thirds of its length (Fig. 88c-e). Frontal punctures minute, shallow, inconspicuous, about one diameter apart; frontal line reaching anterior ocellus. Antennal socket separated

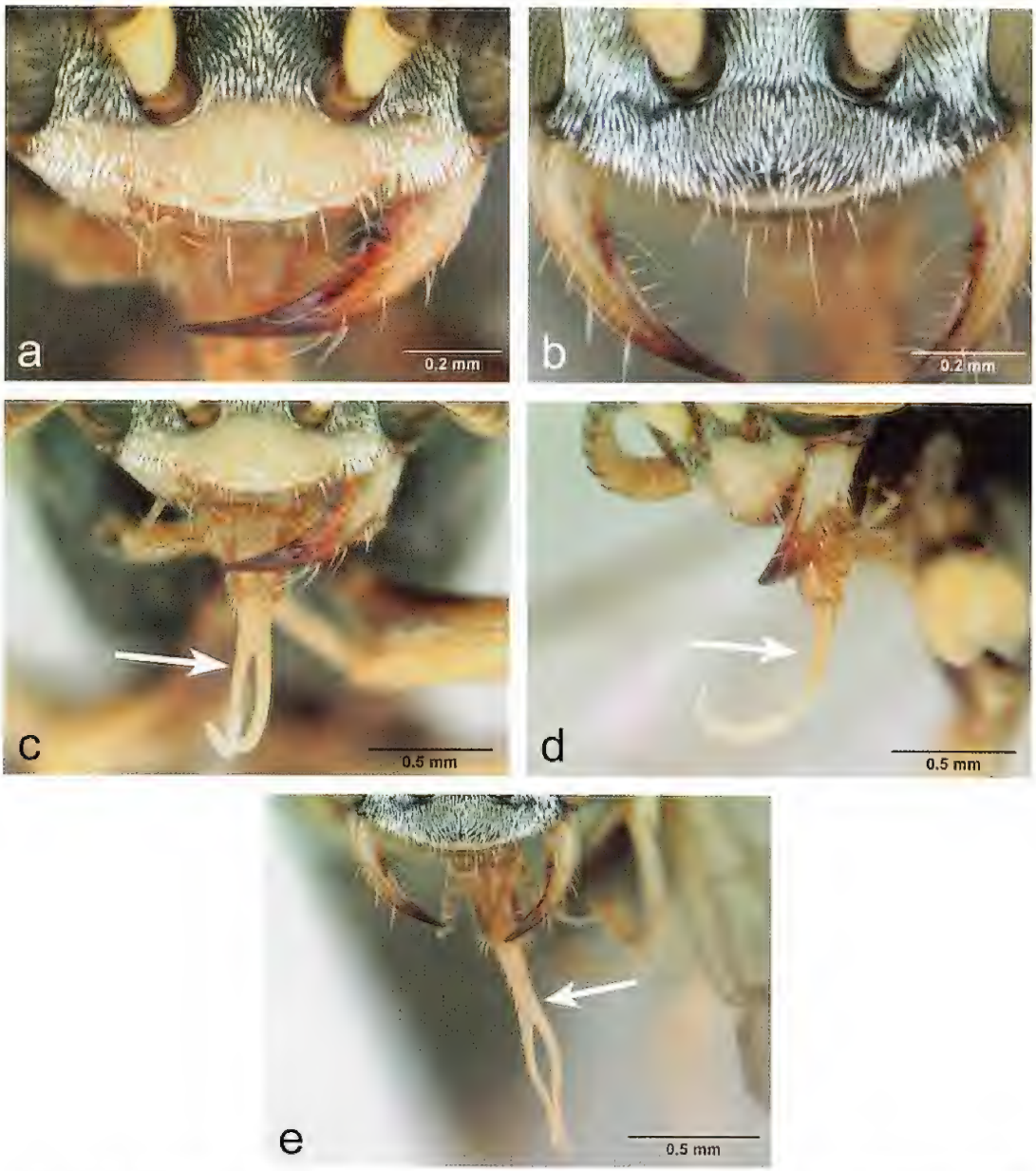

Figure 88. *Sericophorus glossatus* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view; c – lower portion of female head in frontal view (arrow indicates elongate glossa); d – lower portion of female head in lateral view (arrow indicates elongate glossa); e – lower portion of male head in frontal view (arrow indicates elongate glossa).

from clypeal free margin by slightly more than socket width. Ocellocular distance equal to 1.0 × hindocellar width. Clypeal lamella with two lateral teeth on each side in female, but only one ill-defined tooth on each side in male. Scutal punctures well defined, about one diameter apart near center; scutal flange widest apically, ending abruptly. Mesopleural punctures up to about two diameters apart near center; setae partly concealing integument. Propodeal dorsum minutely punctate (interspaces unsculptured), with median carina that is crossed by series of transverse carinae (transverse carinae inconspicuous in male); side alutaceous, punctate posteriorly; posterior surface punctate except for median sulcus. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular; first recurrent vein interstitial with first intersubmarginal vein in one female from Bertholet area, Western Australia. Horizontal area of tergum I with minute punctures that are several diameters apart; apical depressions of terga I-III impunctate.

Setae silvery, obscuring integument on lower frons and most of clypeus; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following: clypeus and scape pale yellow; flagellum yellowish brown ventrally; mandible pale yellow, dark brown apically; pronotal lobe pale yellow, also pronotal collar in male. Fore- and midfemora black except pale yellow apically and ventrally (black basoventrally), hindfemur black except pale yellow apically; female foretibia yellowish brown, pale yellow on outer surface, mid- and hindtibiae pale yellow (brown ventrally in two specimens); male tibiae pale yellow, brown ventrally; tarsi pale yellow, apical tarsomere reddish brown.

♀.— Orbital fovea ill defined. Free margin of clypeal lobe slightly arcuate (Fig. 88a). Dorsal length of flagellomeres I and II about 0.8 × apical width; greatest length of flagellomere IX equal to apical width, of flagellomere X 1.5 × basal width. Forebasitarsus with six to eight rake spines. Setae of pygidial plate not concealing integument. Length 5.8–6.0 mm.

♂.— Free margin of clypeal lobe slightly arcuate (Fig. 88b). Dorsal length of flagellomeres I and II about 1.0 × apical width; greatest length of flagellomere IX equal to 0.8 × apical width, of flagellomere X 1.5 × basal width. Forebasitarsus with six rake spines. Sternum VIII: Fig. 89a. Genitalia: Fig. 89b. Length 4.8 mm.

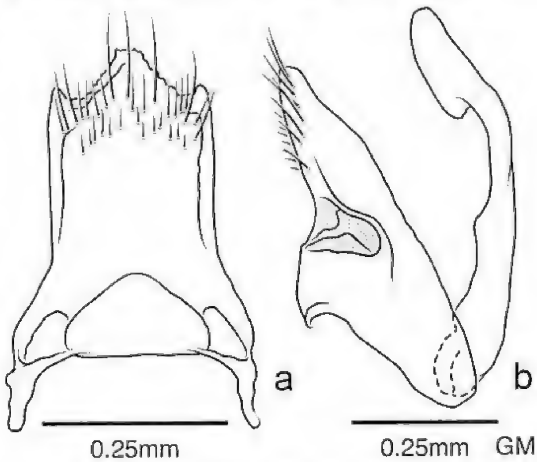

FIGURE 89. *Sericophorus glossatus* Lomholdt, sp. nov: a – male sternum VIII; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 87).— Northern Territory, Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **Western Australia**: West Kimberley, 8 km S Cape Bertholet at 17°19′S 122°10′E, 19 Apr 1977, D.H. Colless (ANIC). PARATYPES: **AUSTRALIA**: **Northern Territory**: Lake Bennett, 28 Dec 1998, M. Generani and P.L. Scaramozzino (1 ♂, CAS); Virginia near Darwin at 12°33′S 131°02′E,25 Apr 1996, S. Gregg (1 ♀, NTM). **Western Australia**: same data as holotype, but 17 Apr 1977 (1 ♀, CAS) and 21 Apr 1977 (1 ♀, ANIC).

***Sericophorus glyptus* Pulawski, sp. nov.**

Figures 90–92.

NAME DERIVATION.— *Glyptus,* from *γλυπτός*, Greek for carved; with reference to the conspicuous propodeal sculpture of this species.

Recognition.— *Sericophorus glyptus* has a predominantly black body (except for the partly yellow or brown appendages, the pale yellow pronotal collar and pronotal lobe, and the reddish brown apical gastral segment), setae appressed on the upper frons and postocellar area, and the apical depression of tergum II punctate throughout or nearly so. It differs from similar species in having the posterolateral area of the propodeal dorsum coarsely, conspicuously ridged or rugose, whereas most of the dorsum is contrastingly obliquely carinate (sculpture concealed by vestiture from many angles), and also in having an irregular ridge separating the propodeal side from the dorsum and posterior surface.

Description.— Head transverse, its maximum width 1.25 × maximum height in both sexes (measured from clypeus ventral margin to top of vertex). Frontal punctures minute, less than one diameter apart; frontal line extending to about frons midheight. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.8 × hindocellar width. Clypeal lamella minimally arcuate (Fig. 90a, b). Scutal punctures about one diameter apart; interspaces almost unsculptured; scutal flange ending abruptly. Mesopleural punctures about one diameter apart, partly concealed by setae; interspaces shiny, unsculptured. Propodeal dorsum punctate, with longitudinal carinae emerging from foremargin and becoming gradually obsolete posterad, with median carina and oblique carinae emerging from it; posterolateral section of dorsum (next to side and posterior surface) with conspicuous irregular ridges or rugae; side unsculptured anteriorly, separated from dorsum and posterior surface by longitudinal ridge; posterior surface with oblique ridges except for median sulcus and with sublateral longitudinal ridge. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular. Horizontal area of tergum I with minute punctures that are several diameters apart; apical depression of tergum II punctate throughout (except for a narrow, almost linear area apicomesally).

Setae silvery, concealing integument on clypeus and on frons lateroventrally; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum, concealing integuments from many angles.

Head, thorax, propodeum, and gaster black except the following: mandible pale yellow basally, dark brown apically; scapal venter yellow; flagellum yellowish brown in distal half (only ventrally so in male); broadly interrupted fascia on pronotal collar and pronotal lobe pale yellow; female tergum VI and male tergum VII reddish brown. Fore- and midfemora black, pale yellow apicoventrally, hindfemur black basally, reddish brown apically; foretibia light brown, midtibia brown, hindtibia brown with pale yellow dorsum; female foretarsus brown, mid- and hindtarsi partly pale yellow; male tarsi all brown.

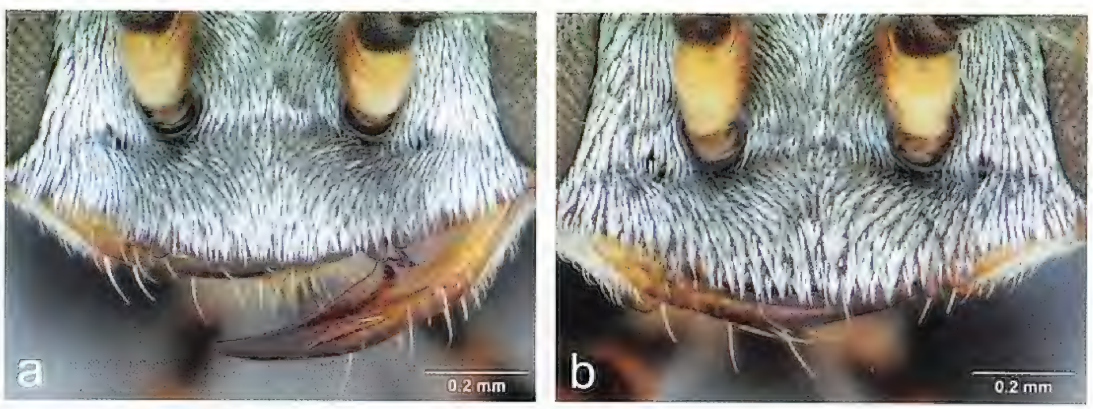

Figure 90. *Sericophorus glyptus* Pulawski, sp. nov. : a – female clypeus in frontal view; b – male clypeus in frontal view.

♀.— Orbital fovea broader than half ocellocular distance. Dorsal length of flagellomere I about 1.0 × apical width, that of flagellomere II 0.8 × apical width; greatest length of flagellomere IX equal to 0.6 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate not concealing integument. Length 4.2–5.3 mm.

♂.— Dorsal length of flagellomere I about 1.1× apical width; that of flagellomere II about 0.8× apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with five or six rake spines. Sternum VIII: Fig. 91a. Genitalia: Fig.91b. Length 4.0–5.2 mm.

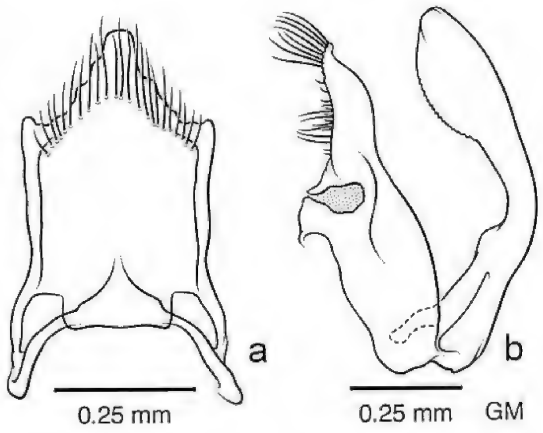

FIGURE 91. *Sericophorus glyptus* Pulawski, sp. nov: a – male sternum VIII; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 92).— Northern part of Northern Territory.

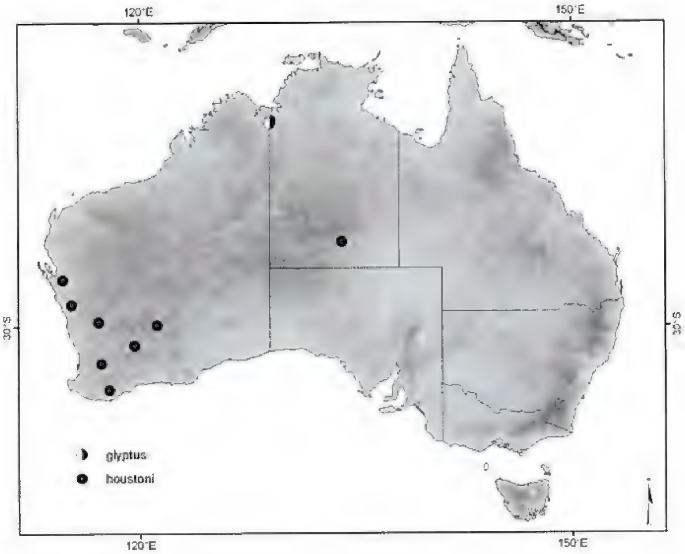

FIGURE 92. Collecting localities of *Sericophorus glyptus* and *houstoni*.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Northern Territory**: Keep River National Park at 15°54′55″S 129°04′11″E, 31 May–3 June 2001, T. Weir, K. Pullen, and P. Bouchard (ANIC). PARATYPES: **AUSTRALIA: Northern Territory**: Fogg Dam, 11 Dec 1997, G.R. Brown (1 ♀, NTM); Keep River National Park at 15°54′55″S 129°04′11″E, 31 May–3 June 2001, T. Weir, K. Pullen, and P. Bouchard (1 ♂, CAS), 15°57′33″S 129°01′44″E, 31 May–3 June 2001, T. Weir, K. Pullen, and P. Bouchard (1 ♀, USU; 1 ♂, ANIC), 10–20 June 2001, M.E. Irwin and F.D. Parker (1 ♀, CAS; 3 ♀, 1 ♂, USU).

***Sericophorus halli* Lomholdt, sp. nov.**
Figures 13, 93, 94.

NAME DERIVATION.— Named after David G. Hall who collected the only known specimen of this species.

RECOGNITION.— The male of *Sericophorus halli*, a New Guinean species, shares with *froggatti*, *funebris*, and *minys* the presence of a sublateral carina on the propodeal dorsum (as in Fig.75e). The female is unknown. Unlike these three species, its posterior mandibular margin is convex between the acetabulum and notch (Fig. 93b) rather than straight; unlike *funebris*, the clypeal middle section is not elevated; and unlike *minys*, the frons is all punctate and setose (rather than unsculptured and glabrous above each antennal scrobe), the propodeal dorsum is punctate and

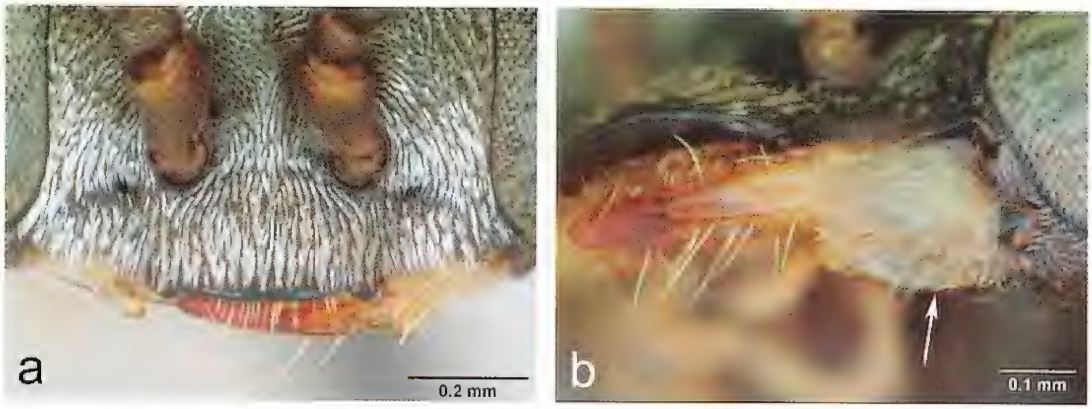

FIGURE 93. *Sericophorus halli* Lomholdt, sp. nov.: a – male clypeus; b – outer surface of male mandible (arrow indicates convexity of posterior margin).

ridged (rather than rugose), the dorsomedian area of the posterior propodeal surface is unsculptured (rather than rugose), the free margin of the male middle clypeal section has one tooth (Fig. 93a) rather than two teeth, and the apical rake spine of the forebasitarsus is slightly shorter than the apical basitarsus width (rather than equal to 1.3 × apical basitarsus width).

DESCRIPTION (based on holotype only).— Frontal punctures about one diameter apart. Frontal line not extending above frontal midheight. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.9 × hindocellar width. Posterior mandibular margin convex between acetabulum and notch (Fig. 93b). Scutal punctures averaging about one diameter apart; scutal flange ending abruptly. Mesopleural punctures averaging about 2–3 diameters apart beneath scrobe. Propodeal dorsum punctate and with a few longitudinal rugae, median carina, sublateral carina, and with longitudinal carina between dorsum and side; side shiny, with minute punctures that are several diameters apart; conspicuously rugose between side and posterior surface; posterior surface punctate except for median sulcus and except laterally, with rugose dorsomedian area that is delimited laterally by sharp carina. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell narrowly open. Tergum I: punctures of horizontal area 2–3 diameters apart; apical depression impunctate mesally; apical depression of tergum II nearly all punctate. Sternum I with simple median ridge basally.

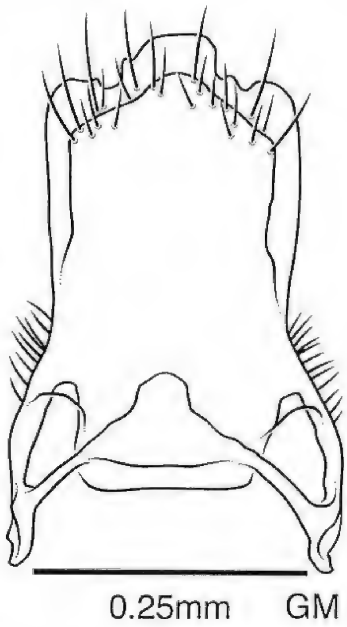

FIGURE 94. *Sericophorus halli* Lomholdt, sp. nov.: male sternum VIII.

Setae of lower frons and clypeus silvery, partly obscuring integument; appressed on upper frons, postocellar area, and scutum; nearly appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following: mandible yellow basally, reddish brown apically, flagellum reddish brown ventrally, pronotal collar with medially interrupted pale yellow fascia, pronotal lobe pale yellow. Femora reddish brown basally, pale yellow apicoventrally; tibiae and tarsi reddish brown.

♀.— Unknown.

♂.— Clypeal lamella straight, with obtuse lateral tooth (Fig. 93a). Dorsal length of flagellomere I 0.9 × apical width (ventral length smaller than apical width), of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.1 × basal width. Forebasitarsus with five rake spines. Sternum VIII: Fig. 94. Genitalia lost. Length 4.5 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 13).— Known from one locality in Papua New Guinea.

RECORDS.— HOLOTYPE: ♂, **PAPUA NEW GUINEA: Morobe Province**: Nadzab at 6°35′S 146°46′E, 8 Nov 1944, David G. Hall (USNM).

***Sericophorus houstoni* Lomholdt, sp. nov.**

Figures 92, 95, 96.

NAME DERIVATION.— Named after Terry F. Houston, who collected the holotype.

RECOGNITION.— *Sericophorus houstoni* has the setae erect on upper frons and interocellar area in female (equal to about 0.4 of midocellar width), appressed in male; appressed on postocellar area and scutum in both sexes. It can be instantly recognized by its conspicuously rugose propodeal dorsum (Fig. 95c). Subsidiary recognition features are: clypeus, antenna, and forecoxa black, forebasitarsus rake spines long (length of apical spine about 2.2 × apical width of basitarsus in female, about 1.5 × in male), and terga I and II reddish brown in the female.

DESCRIPTION.— Frontal punctures minute but well defined, about 1–2 diameters apart; interspaces finely microsculptured but shiny; frontal line reaching midocellus (inconspicuous in male and some females). Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to hindocellar width. Ventral half or so of middle clypeal section sparsely punctate and setose; lamella straight or nearly so, outer tooth prominent in female. Scutal punctures less than one diameter apart anteriorly, about two diameters apart near center and posteromesally; scutal flange ending abruptly. Mesopleural punctures about one diameter apart near center. Propodeal dorsum conspicuously rugose, foveolate anteriorly, with median, glabrous impression (Fig. 95c); side ridged, conspicuously so

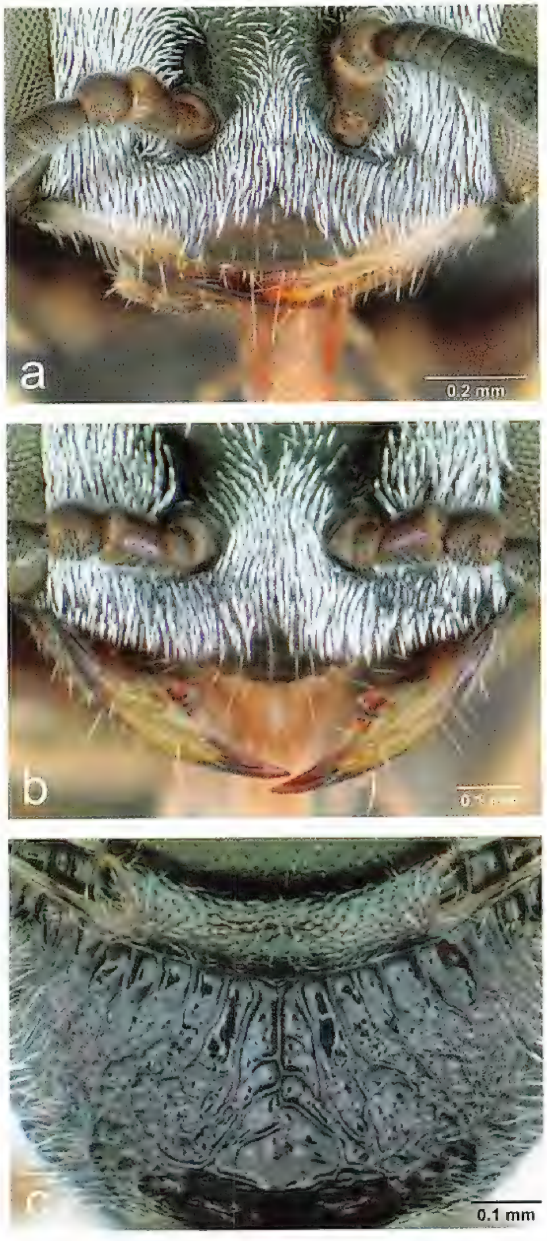

FIGURE 95. *Sericophorus houstoni* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view; c – propodeal dorsum of female in dorsal view.

near posterior margin, with irregular, longitudinal carinae near posterior surface; posterior surface irregularly ridged except for median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly, but triangular in some males. Horizontal area of tergum I with punctures that average 1–2 diameters apart; apical depression impunctate posteriorly, markedly microsculptured.

Setae silvery, obscuring integument on lateral frons and most of clypeus; erect on upper frons and interocellar area in female (equal to about 0.4 of midocellar width), appressed in male; appressed on postocellar area and scutum in both sexes; nearly appressed, oriented anterad on propodeal dorsum.

Head including antenna black, mandible pale yellow, brown apically. Thorax and propodeum black, pronotal lobe pale yellow in female and some males. Female forefemur black (pale yellow apically), midfemur black or yellowish brown dorsally and on inner surface (pale yellow apically), hindfemur black either basally or up to about midlength (remainder reddish brown); fore- and midtibiae reddish brown, pale yellow on outer surface, hindtibia mainly reddish brown; fore- and midtarsi pale yellow, hindtarsus brown; male femora black, with apical fourth pale yellow, tibiae and tarsi pale yellow. Terga I and II reddish brown in female (tergum II may be partly black), remaining terga black; gaster all black in male.

♀.— Orbital fovea ill defined, about as wide as or wider than half ocellocular distance. Free margin of clypeal lobe slightly arcuate (Fig. 95a). Dorsal length of flagellomere I about 1.1 × apical width, of flagellomere II 0.7 × apical width; greatest length of flagellomere IX equal to 0.5 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with 5–7 rake spines, length of apical spine about 2.2 × apical width of basitarsus. Setae of pygidial plate not concealing integument except apically. Length 5.0–6.0 mm.

♂.— Free margin of clypeal lobe slightly arcuate (Fig. 95b). Dorsal length of flagellomere I about 1.0× apical width, of flagellomere II about 0.6× apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with 3–5 rake spines, spine length up to about 1.5 × basitarsus apical width. Sternum VIII emarginate apically (Fig. 96a). Genitalia: Fig. 96b. Length 4–5 mm.

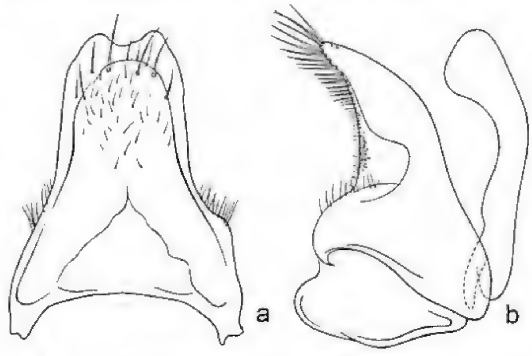

FIGURE 96. *Sericophorus houstoni* Lomholdt, sp. nov.: a – male sternum VIII; ; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 92).— Northern Territory and Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **Western Australia**: Tutanning Reserve 18–25 km E Pingelly, 30 Oct–3 Nov 1980, T.F. Houston (WAMP). PARATYPES: **AUSTRALIA**: **Northern Territory**: 56 km SE Alice Springs at 24°11′S 134°01′E, 3 Oct 1978, J.C. Cardale (12 ♂, ANIC; 2 ♂, CAS). **Western Australia**: same data as holotype (1 ♀, 1 ♂, CAS; 1 ♀, 1 ♂, WAMP); Bindoo Hill Nature Reserve ca 27 km W Mullewa, 12 Sept 1987, T.F. Houston (1 ♀, CAS); Dryandra State Forest ca 30 km NW Narrogin, on flowers and foliage of *Adenanthos cygnorum* Diels (Proteaceae), 21–22 Feb 1996, T.F. Houston and C.K. Bosse (1 ♂, ANIC; 1 ♂, CAS; 4 ♂, WAMP); Goongarrie at 29°54′00″S 121°10′10″E, 6 Oct 1980, *Casuarina* woodland, W.F. Humphreys (1 ♂, WAMP); Stirling Range National Park at 34°23.6′S 117°49.6′E, 6 Dec 2008, D.M. Bray and W.J. Pulawski (1 ♀, CAS); 13 km S of Wannoo at 26°49′S 114°37′E, 21–23 Aug 1986, T.F. Houston (1 ♂, WAMP); 64 km NE Wubin at 29°42′S 117°06′E, 28 Sept 1981, I.D. Naumann and J.C. Cardale (1 ♂, ANIC); 4 km W of Yellowdine at 31°18′S 119°37′E, 10 Aug 1986, I.D. Naumann and J.C. Cardale (1 ♀, ANIC).

***Sericophorus iridipennis* (Turner)**
Figures 97–99.

Zoyphium iridipenne Turner, 1914:356, ♀. Lectotype: ♀, Australia: Tasmania: Eaglehawk Neck (BMNH), **present designation by O. Lomholdt**, examined by O. Lomholdt and W. Pulawski.— Turner, 1915:552 (Tasmania).— As *Sericophorus iridipennis*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:253 (in catalog of Australian Sphecidae).

Zoyphium fuscipenne Hacker and Cockerell, 1922:289, ♀. Holotype: ♀, Australia: Tasmania: Wedge Island (QMB), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— As *Sericophorus fuscipennis*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:252 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus iridipennis* has the setae appressed on the upper frons and postocellar area, the head, thorax, propodeum, forecoxa, and gaster black (pronotal lobe reddish), the leg contrastingly reddish brown to yellowish red, with no yellow markings; the pronotal collar not reaching the level of the scutum (Fig. 97f), its dorsum being linear in dorsal view (Fig. 97e), the propodeal dorsum finely, obliquely ridged, without sublateral carina, and the apical depression of tergum II impunctate. Additional characters include: clypeus without elevation, axilla not expanded, and frons densely punctate. In the male, the clypeal lamella is obtusely angulate laterally (Fig. 97d). *S. vicarius* is similar, but in *iridipennis* the antenna is black and in the female the clypeus is black, with the lamella straight. In *vicarius*, the antenna is largely yellowish brown or reddish brown and in the female the clypeal lamella is arcuate and the clypeus is all or partly yellow. Unlike *punctum* (whose female is unknown), the male of *iridipennis* has nonprominent lateral corner of the clypeal lamella (rather than angulate), and the head width is slightly less than 1.2 × length, length measured from midpoint of clypeal free margin to top of vertex (rather than 1.3 ×, compare Figs. 00 and 00). A subsidiary recognition feature of *iridipennis* is a slightly elongate female head (Fig. 97a).

Description.— Head longer than average for *Sericophorus* (Fig. 97a, b), its maximum width 1.25 × maximum height in female, about 1.20 × in male (measured from clypeus ventral margin to top of vertex). Frontal punctures minute, shallow, inconspicuous, about one diameter apart; frontal line evanescent or absent. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.7 × hindocellar width. Scutal punctures well defined, about one diameter apart; scutal flange widest apically, ending abruptly. Mesopleural punctures about 2–3 diameters apart below scrobe in female, about 1–2 in male; interspaces slightly microareolate, shiny. Propodeal dorsum obliquely ridged (ridges conspicuous basally, gradually finer posteriorly), with punctate interspaces, slightly concave median, glabrous area, and well-defined median carina; side in female with evanescent ridges (unsculptured anteriorly), in male all ridged; posterior surface in female punctate and minutely ridged (except for median sulcus), ridged (except for median sulcus) in male. Forewing vein M interstitial with cu-a or diverging from M+Cu slightly basad of cu-a; second submarginal cell triangular. Horizontal area of tergum I with punctures that average several diameters apart; apical depressions of terga impunctate.

Setae silvery, not obscuring integument on frons and clypeus; appressed on upper frons, postocellar area, and scutum; on propodeal dorsum appressed, inconspicuous, oriented anterad (integument glabrous along midline, broadly so at apex).

Head (including antenna), thorax, propodeum, and gaster black except the following: female clypeus brown adjacent to lamella; mandible yellow or yellowish red (black basally in many males), dark brown apically; pronotal lobes dark reddish; legs reddish brown to yellowish red (coxae black, forefemur black except reddish brown apically).

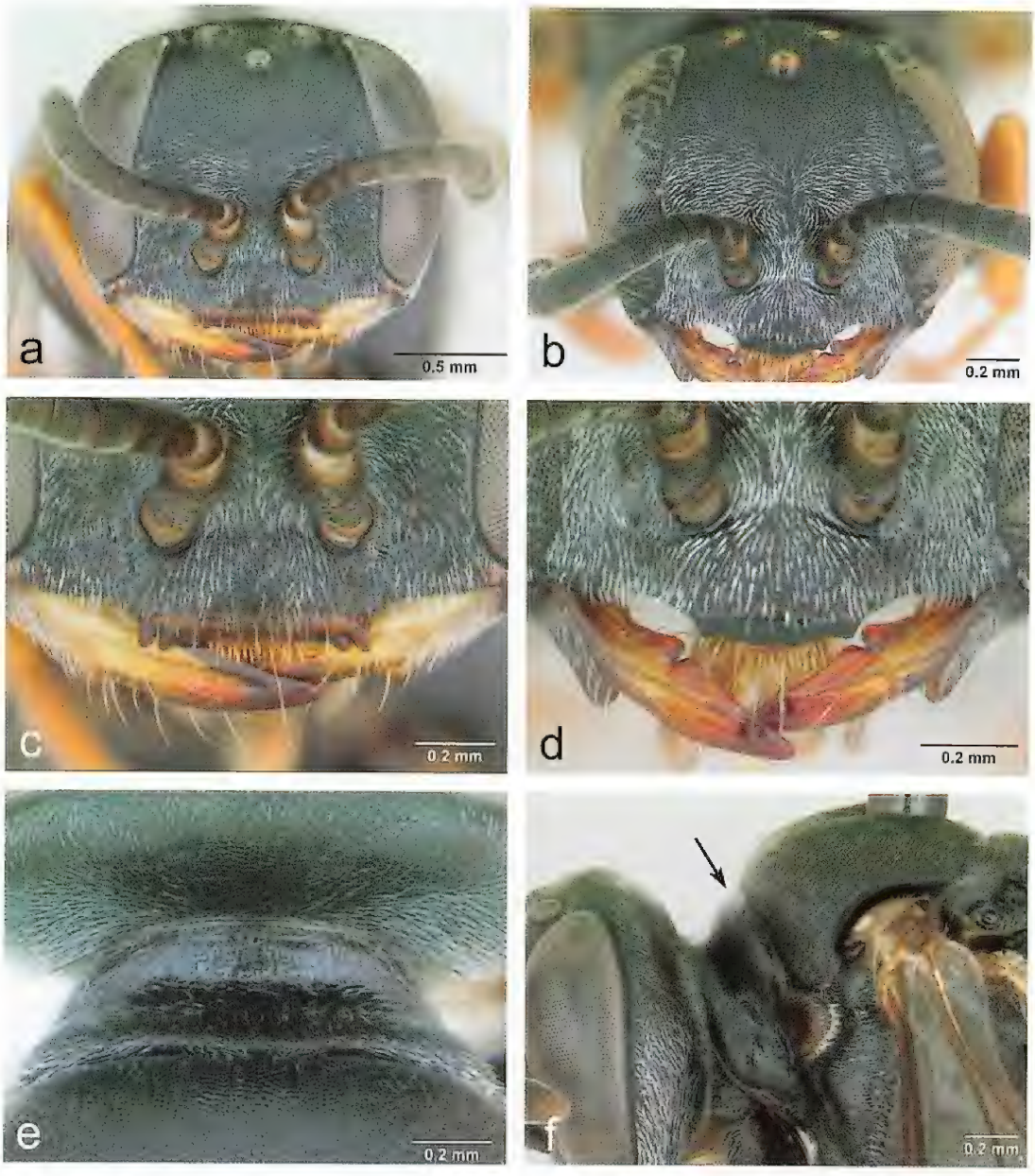

FIGURE 97. *Sericophorus iridipennis* (Turner): a – female head in frontal view; b – male head in frontal view; c – female clypeus in frontal view; d – male clypeus in frontal view; e – female pronotum in dorsal view; f – female pronotum in lateral view (arrow indicates pronotal collar not attaining level of scutum).

♀.— Free margin of clypeal lamella straight or minimally concave, lateral teeth prominent (Fig. 97c). Orbital fovea ill defined or absent. Dorsal length of flagellomere I 1.4 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.5 × basal width. Setae of pygidial plate concealing integument apically. Forebasitarsus with six or seven rake spines. Length 4.8–5.8 mm.

♂.— Clypeal lamella obtusely angulate laterally (Fig. 97d). Dorsal length of flagellomere I 0.7

× apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.4 × basal width. Sternum VIII: Fig. 98a. Genitalia: Fig. 98b. Length 4.0–4.3 mm.

Geographic distribution (Fig. 99).— Tasmania.

Records.— AUSTRALIA: Tasmania: 3 km ESE Black River at 40°52′S 145°20′E, 18 Jan 1983 (1 ♂, ANIC); 15 km ENE Cranbrook at 41°57′S 148°14′E, 28 Jan 1983 (1 ♂, ANIC); Eaglehawk Neck, 12 Feb–3 Mar 1913 (2 ♀, 1 ♂, BMNH, lectotype and paralectotypes of *Zoyphium iridipenne*), 22 Feb 1913 (1 ♀, BMNH); Frodshams Pass at 42°49′S 146°23′E, 24–25 Jan 1983 (6 ♂, ANIC; 2 ♂, CAS); 7 km S Frodshams Pass at 42°53′S 146°22′E, 25 Jan 1983 (1 ♂, ANIC); 12 km SW Frodshams Pass at 42°51′S 146°14′E, 25 Jan 1983 (1 ♀, 1 ♂, ANIC; 1 ♀, CAS); 1 km SSE Gladstone at 40°58′S 148°01′E, 29 Jan 1983 (2 ♂, ANIC); Hobart, 4 Jan 1951 (1 ♂, ANIC); Meredith River 12 mi. from Corinna, 6 Jan 1954 (1 ♀, 1 ♂, ANIC; 1 ♀, CAS); Mount Field National Park, 8–14 Jan (1 ♀, AEI); Rosebery, 12 Jan–12 Mar (2 ♀, AEI); Strahan, 8–14 Mar (1 ♀, AEI); Wedge Island, 4 Jan 1914 (1 ♀, QMB, holotype of *Zoyphium fuscipenne*).

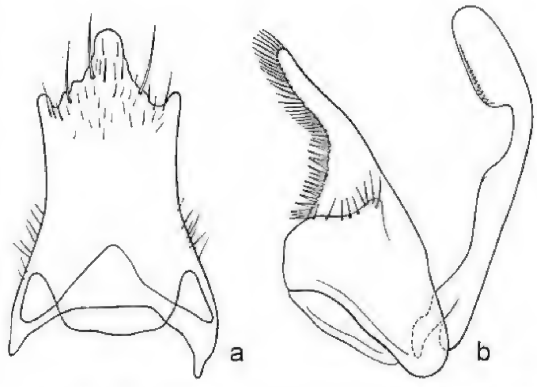

FIGURE 98. *Sericophorus iridipennis* (Turner): a – male sternum VIII; b – male genitalia in lateral view.

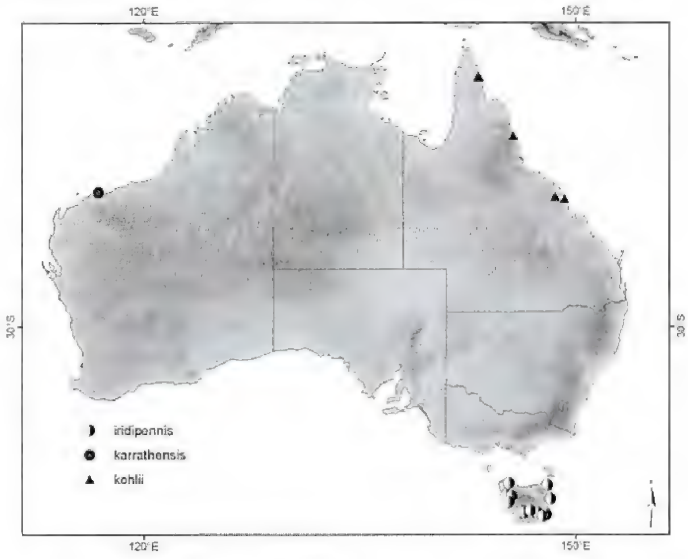

FIGURE 99. Collecting localities of *Sericophorus iridipennis*, *karrathensis*, and *kohlii*.

***Sericophorus karrathensis* Pulawski, sp. nov.**
Figures 99, 100.

Name derivation.— *Karrathensis* is a Neolatin adjective derived from Karrratha, the type locality.

Recognition.— *Sericophorus karrathensis* is largely unspecialized: the setae are appressed on the interocellar area and vertex, three submarginal cells are present, the axilla is not expanded laterally, and the basolateral carina of tergum I ends well before the spiracle. The middle clypeal section, however, is specialized: elevated medioventrally, with the ventral surface of the elevation concave, glabrous (Fig. 100a, b). Additionally, the species can be recognized by its coloration: thorax black except for the pale yellow pronotal collar, reddish brown scutellum and metathorax, and legs without yellow spots.

Description (based on holotype only).— Frontal punctures fine, about one diameter apart; frontal line not extending above frontal midheight. Ocellocular distance equal to 0.8 × hindocellar

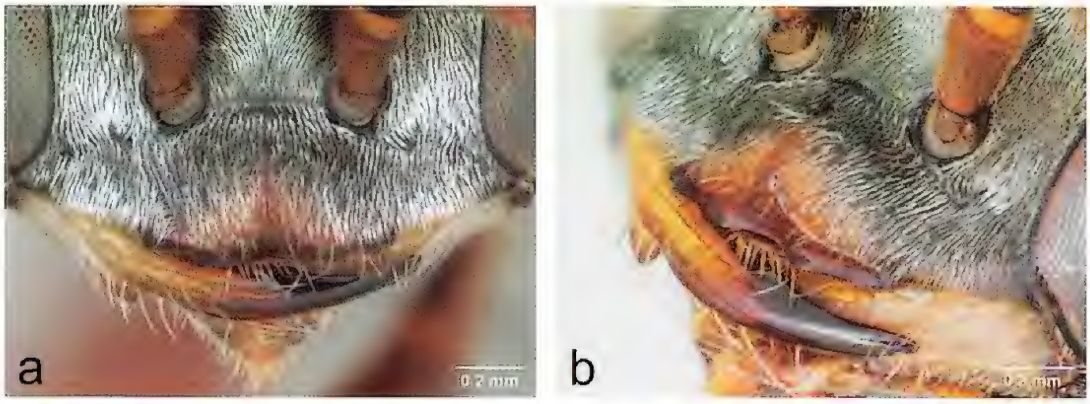

FIGURE 100. *Sericophorus karrathensis* Pulawski, sp. nov.: a – female clypeus in frontal view; b – female clypeus in lateral oblique view.

width. Interocellar area convex adjacent to hindocellus, concave mesally. Middle clypeal section elevated medioventrally; ventral surface of elevation concave, shiny, glabrous, about as long mesally as 0.8 × midocellar width (Fig. 100a, b). Propleuron somewhat protruding posterolaterally. Scutal punctures about one diameter apart; scutal flange gradually narrowing posterad. Mesopleural punctures about 2–3 diameters apart near center. Propodeal dorsum finely punctate, shiny, crenulate along foremargin, with shallow median sulcus that includes median carina; side microscopically punctate except unsculptured anteriorly; posterior surface finely punctate except for median sulcus. Forewing vein M diverging from M+Cu slightly distad of cu-a; second submarginal cell triangular. Tergum I: punctures of horizontal area averaging about two diameters apart; apical depression punctate; apical depression of tergum II punctate.

Setae of lower frons and clypeus silvery, not obscuring integument; appressed on upper frons, postocellar area, and scutum; appressed, oriented anteromesad on propodeal dorsum.

Head black except the following: clypeus yellowish brown medioventrally (lamella dark brown); pedicel reddish brown, flagellum dark brown dorsally, reddish brown ventrally; mandible pale yellow basally, dark brown apically. Thorax, propodeum, and gaster black except pronotal collar pale yellow, scutellum dark reddish brown, metanotum dark yellowish red, apical depressions of terga I-V yellowish brown, and apex of pygidial plate reddish brown. Femora and tibiae reddish brown, but the following are dark brown: forefemur basally and posteriorly, hindfemur apicodorsally, and hindtibia dorsally; tarsi dark brown.

♀.— Orbital fovea well defined, practically reaching hindocellus. Clypeal lamella without lateral teeth on right side, with one rudimentary tooth on left side. Dorsal length of flagellomeres I and II 1.1 × apical width, greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with seven rake spines. Setae of pygidial plate fully concealing integument near apex. Length 8.1 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 99).— Known from one locality in northern part of Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **Western Australia**: Karratha at 20°44.4'S 116°50.2'E, 19–29 Apr 2003, M.E. Irwin and F.D. Parker (ANIC).

***Sericophorus kohlii* (Turner)**
Figures 99, 101, 102.

Zoyphium kohlii Turner, 1908:495, ♀. Holotype: ♀, Australia: Queensland: Mackay (BMNH), examined by O. Lomholdt and W. Pulawski.— Turner, 1914:357 (in revision of Australian *Zoyphium*).— As *Sericophorus kohlii*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:253 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus kohlii* is similar to *crassicornis*. See that species (p. 68) for recognition characters.

Description.— Frontal punctures minute, less than one diameter apart; frontal line extending to about frontal midheight. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.7 × hindocellar width in female, 0.9 × in male. Scutal punctures less than one diameter apart; scutal flange widest apically, ending abruptly. Mesopleural punctures less than one diameter apart, interspaces slightly shiny. Propodeal dorsum punctate, with short ridges along anterior margin and sharp median carina in shallow, longitudinal depression; side minutely punctate, unsculptured anteriorly; posterior surface minutely punctate between ridges except for median sulcus. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular or narrowly open anteriorly; second and third submarginal cells fused in left forewing in single male examined. Terga with well-defined punctures, interspaces slightly microsculptured, shiny; apical depressions impunctate, punctures several diameters apart on horizontal portion of tergum I.

Setae not concealing integument on lower frons and clypeus, golden in female, with golden tinge in male; appressed on upper frons, postocellar area, and scutum; on propodeal dorsum inconspicuous, appressed, oriented anterad (integument glabrous apicomesally).

Head, thorax, propodeum, and gaster black except the following: female clypeus narrowly reddish along lamella, mandible yellow basally, dark brown apically, scape brown or reddish brown, flagellum reddish brown (antenna missing in single male examined). Legs reddish brown, forecoxa black basally, yellow apically.

♀.— Orbital fovea ill-defined, almost reaching hindocellus. Dorsal length of flagellomeres I and II 1.0 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with six or seven rake spines. Setae of pygidial plate not concealing integument except apically. Length about 6.0 mm.

♂.— Clypeal lamella rounded laterally, without teeth. Facial pubescence lighter and denser than in female. Antennae missing in single specimen available. Forebasitarsus with four rake

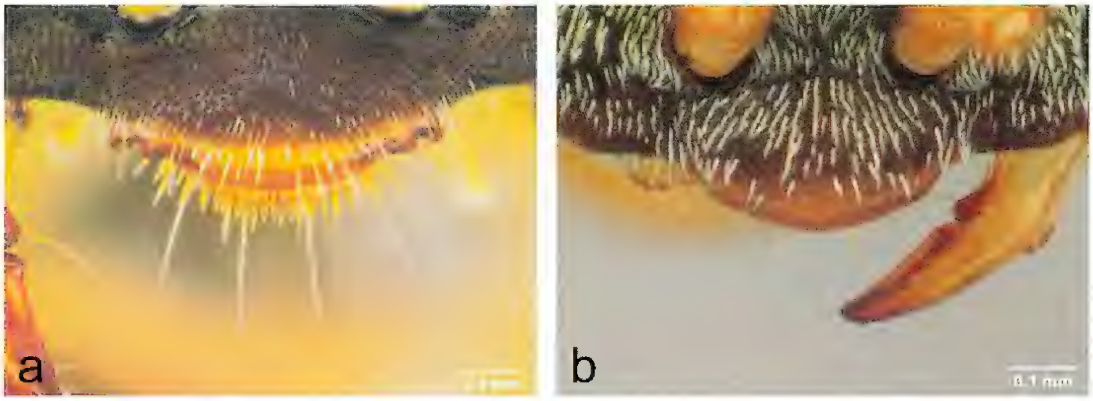

Figure 101. *Sericophorus kohlii* (Turner): a – female clypeus in frontal view; b – male clypeus in frontal view.

spines. Sternum VIII: Fig. 102a. Genitalia: Fig. 102b. Length 4.4 mm.

Geographic distribution (Fig. 99).— Queensland.

Records.— AUSTRALIA: Queensland: Claudie River near Mount Lamond, 4 Jan 1972 (2 ♀, AMS); Eungella National Park, 8 Feb 1978 (1 ♀, UCD); Kuranda, no date (1 ♀, 1 ♂, BMNH); Mackay, Jan 1901 (1 ♀, BMNH, holotype of *Zoyphium kohlii*); 1 mi. NE Mount Lamond in Iron Range, 18 and 19 Jan 1972 (2 ♀, ANIC); 9 km ENE Mount Tozer at 12°43′S 143°17′E, 5–10 July 1986 (1 ♀, ANIC).

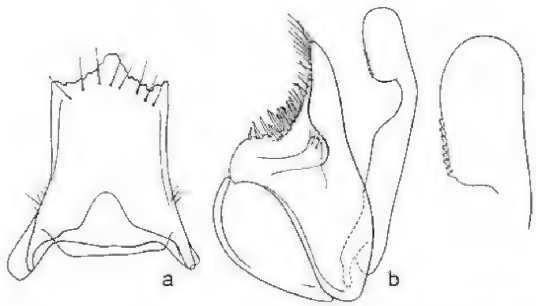

Figure 102. *Sericophorus kohlii* (Turner): a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

Sericophorus laevigatus (Rayment)

Figures 103–105

Anacrucis laevigata Rayment, 1955a:56, ♀. Holotype: ♀, Australia: Victoria: Frankston (NMV), examined by O. Lomholdt and W. Pulawski.— As *Sericophorus laevigatus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:253 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus laevigatus* has the setae of the upper frons and postocellar area appressed, thorax, propodeum and gaster black (female pygidial plate reddish brown), the legs contrastingly reddish brown and with no yellow markings, propodeal dorsum punctate (not ridged), and the apical depression of terga I and II is largely impunctate mesally. *Sericophorus chrysophorus*, *iridipennis* and *striatulus* are similar, but *laevigatus* differs in having the posterior margin of the mandible slightly convex between the articulation and notch (rather than straight), propleuron expanded posterolaterally (rather than not expanded), propodeal dorsum punctate (rather than ridged), clypeal lamella of female tridentate laterally (Fig. 103a) rather than bidentate, and male flagellomeres III-V convex ventrally (rather than cylindrical). Unlike *iridipennis* and *striatulus*, the propodeal dorsum of *laevigatus* is punctate rather than ridged.

Description .— Frons swollen near center; frontal punctures about one diameter apart; frontal line attaining midocellus, conspicuous on central swelling, inconspicuous in frons upper half; interocellar area convex adjacent to hindocellus, concave mesally. Orbital fovea well defined in both sexes, matt, its width less than 0.5 × ocellocular distance. Antennal socket separated from

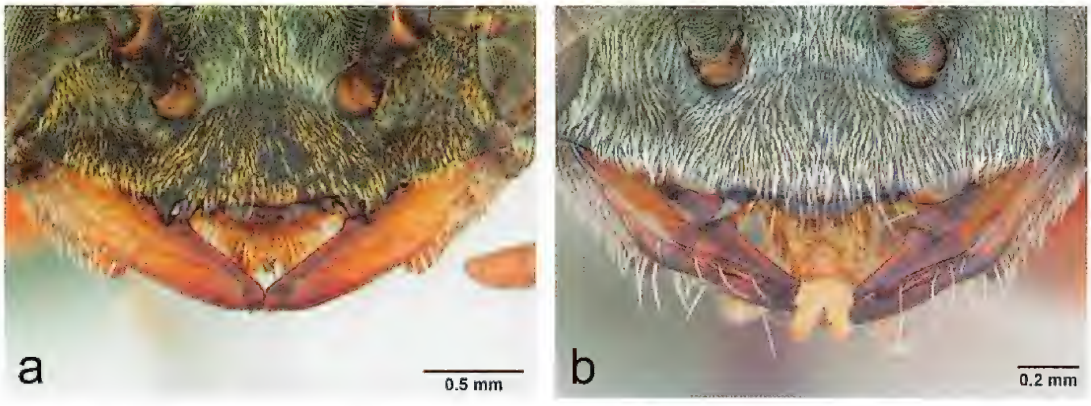

Figure 103. *Sericophorus laevigatus* (Rayment): a – clypeus of female holotype in frontal view; b – male clypeus in frontal view.

clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.3 × hindocellar width. Mandibular posterior margin convex between articulation and notch (as in Fig. 112c). Propleuron prominent posterolaterally. Scutal punctures about one diameter apart; scutal flange ending abruptly. Mesopleural punctures about two diameters apart near center; interspaces conspicuously microareolate. Propodeal dorsum punctate, with short but conspicuous longitudinal ridges emerging from foremargin, with median carina but without median sulcus; side aciculate anteriorly, aciculate and punctate posteriorly, with a few longitudinal ridges just below and behind spiracle; posterior surface punctate except for median sulcus. Forewing vein M diverging from M + Cu basad of cu-a; second submarginal cell triangular. Punctures of tergum I several diameters apart near center preapically. Apical depressions of terga II and III microareolate, impunctate mesally.

Setae dark golden on upper frons, brassy on lower frons, partly obscuring integument; appressed on upper frons and postocellar area; partly suberect on scutum; suberect, oriented obliquely anterad on propodeal dorsum (dorsum glabrous along midline).

Head, thorax, propodeum, and gaster black except flagellum brown, reddish brown ventrally; mandible yellowish brown basally, dark brown apically; pronotal lobe with reddish tinge; and female pygidial plate dark reddish brown. Legs reddish brown.

♀.— Clypea lamella narrow, concave, tridentate laterally (Fig. 103a). Dorsal length of flagellomere I 1.5 × apical width, of flagellomere II 1.3 × apical width; greatest length of flagellomere IX 1.1 × apical width, of flagellomere X 1.5 × basal width. Forebasitarsus with seven rake spines. Length 11.8 mm.

♂.— Clypeal lamella slightly protruding mesally (Fig. 103b), separated by obtuse carina from remaining clypeal surface. Dorsal length of flagellomere I 1.4 × apical width, of flagellomere II 1.2 × apical width; greatest length of flagellomere IX 1.2 × apical width, of flagellomere X 1.8 × basal width; flagellomeres III-V convex ventrally. Forebasitarsus with six rake spines. Sternum VIII: Fig. 104a. Genitalia: Fig. 104b. Length 8.2 mm.

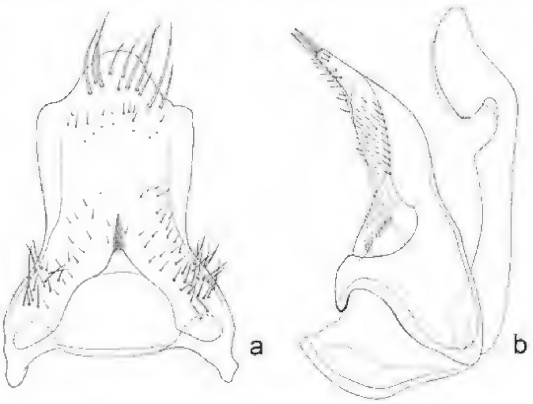

FIGURE 104. *Sericophorus laevigatus* (Rayment): a – male sternum VIII; b – male genitalia in lateral view.

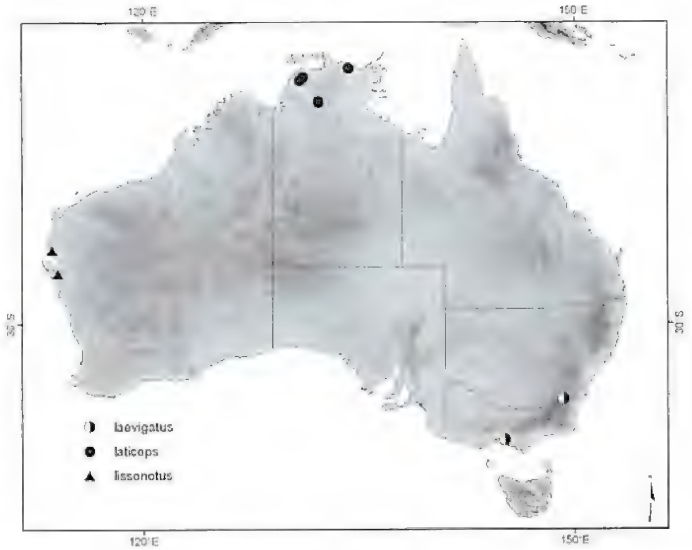

FIGURE 105. Collecting localities of *Sericophorus laevigatus*, *laticeps*, and *lissonotus*.

GEOGRAPHIC DISTRIBUTION (Fig. 105).— Known from two localities, one in Australian Capital Territory, the other in Victoria.

Records.— **AUSTRALIA**: **Australian Capital Territory**: Canberra, 2 Feb 1950 (1 ♂, ANIC). **Victoria**: Frankston, Jan 1950 (1 ♀, NMV, holotype of *Anacrucis laevigata*).

***Sericophorus laticeps* Lomholdt, sp. nov.**
Figures 105, 106.

Name derivation.— *Laticeps*, Latin adjective meaning *with wide head.*

Recognition.— The female of *laticeps* (the male is unknown) is unique in having an unusually wide head (Fig. 106a): width about 1.5 × length, clypeal width about 8 × midline. Additionally, the antennal socket is separated from the clypeal free margin by less than socket width (Fig. 106b), the free margin of the clypeal middle lobe is double-edged (the area between edges is glabrous, slightly concave), the thorax, propodeum, and gaster are black (pronotal lobe dark reddish brown), and the femora, tibiae, and tarsi are pale yellow.

Description.— Head unusually wide (Fig. 106a), width about 1.5 × length (length measured from midpoint of clypeal free margin to top of vertex). Frontal sculpture indistinguishable under short, golden, appressed setae; frontal line evanescent. Antennal socket separated from clypeal free margin by less than socket width (Fig. 106b). Ocellocular distance equal to about 1.2 × hindocellar width. Clypeus slightly raised along midline; lamella broadly, shallowly emarginate, double-edged; area between edges concave, glabrous; lateral teeth inconspicuous (Fig. 106b). Scutal punctures well defined, up to 3–4 diameters apart near center (some punctures less than one diameter apart); interspaces aciculate, somewhat shiny; scutal flange ending abruptly. Mesopleuron aciculate, with microscopically small punctures that are several diameters apart. Propodeal dorsum with well-defined, longitudinal ridges basally, remainder with oblique microridges and finely punctate interspaces, with well-defined median carina; median sulcus present only apically; side microareolate, somewhat shiny; posterior face dull, microsculptured (except mesally). Forewing vein M diverging from M+Cu basad of, but very close to, cu-a; second submarginal cell markedly narrowed anteriorly in most specimens, triangular in some. Punctures of tergum I several diameters apart (less than that laterally); interspaces unsculptured, partly aciculate; apical depressions of terga I-V impunctate.

Setae appressed on head, scutum, and propodeal dorsum, oriented anterad on propodeal dorsum.

Head, thorax, and propodeum black except the following are pale yellow: clypeus, scape, and pedicel in most specimens (clypeus black, scape brown, and pedicel largely brown in two females from Maningrida, Northern Territory), and mandible (mandible dark brown apically); flagellum

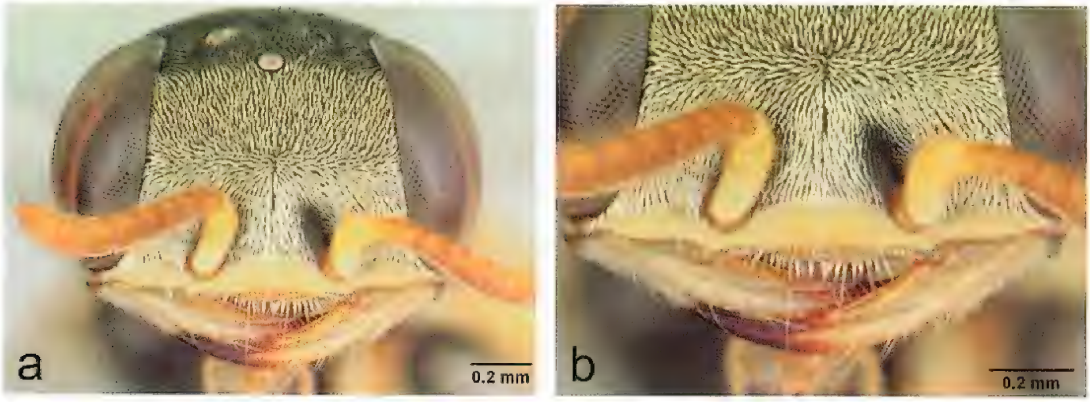

Figure 106. *Sericophorus laticeps* Lomholdt, sp. nov.: a – female head in frontal view; b – female clypeus in frontal view.

yellowish brown; pronotal lobes dark reddish brown. Coxae varying from yellow to black, femora, tibiae and tarsi pale yellow. Gaster black.

♀.— Orbital fovea rudimentary. Free margin of clypeal free margin double-edged, lamella with two ill-defined lateral teeth. Dorsal length of flagellomere I about 1.0 × apical width, of flagellomere II about 0.8 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X about 1.4 × basal width. Forebasitarsus with four or five rake spines. Setae of pygidial plate partly concealing integument. Length 3.8–5.6 mm.

♂.— Unknown.

Geographic distribution (Fig. 105).— Northern Territory north of 15°S.

Records.— Holotype: ♀, **AUSTRALIA: Northern Territory**: 11 mi. S Katherine, 14 Mar 1975, on *Eucalyptus foelcheana*, E.M. Exley (UQIC). Paratypes: **AUSTRALIA: Northern Territory**: Kakadu National Park: Kapalga Research Station, 24 Dec 1993–7 Jan 1994, S. and J. Peck (1 ♀, NTM); 9 mi. S Katherine, 14 Mar 1975, on *Eucalyptus bleeseri*, E.M. Exley (1 ♀, CAS); Litchfield National Park at 13°03′17″S 130°54′18″E, 29 Dec 1999, C. Generani and P.L. Scaramozzino (1 ♀, CAS); Maningrida, J.L. and M. Gressitt, 18 Mar 1961 (1 ♀, BISH), 19–20 Mar 1961 (1 ♀, BISH), 22 Mar 1961 (1 ♀, CAS); Manton River 46 mi. S Darwin, 13 Mar 1973, E.M. Exley (1 ♀, UQIC).

***Sericophorus lissonotus* Lomholdt, sp. nov.**

Figures 105, 107.

Name derivation.— From Greek *λισσός*, smooth, shiny, and *νώτος*, back; with reference to the shiny scutum.

Recognition.— Like *emarginatus* and *niger*, *lissonotus* has the pronotal collar conspicuously emarginate mesally (Fig. 107c, see also 59e). It differs from these two species in having the clypeus all yellow (rather than partly or all black) and sparser scutal and mesopleural punctation (scutal punctures mesally one or two diameters apart, mesopleural punctures mesally averaging several diameters apart). In *emarginatus* and *niger*, the scutal punctures are less than one diameter apart and the mesopleural punctures about one diameter apart).

Description.— Frons with central swelling, its punctures nearly contiguous; frontal line fine, recognizable only in ventral half of frons. Ocellocular distance about equal to hindocellar width. Clypeal lamella slightly arcuate. Pronotal collar conspicuously emarginate mesally and also broadly emarginate posterolaterally, as in *emarginatus* (Fig. 59e). Scutal punctures, near center, averaging between one and two diameters apart; interspaces unsculptured, shiny; scutal flange ending abruptly. Mesopleural punctures averaging several diameters apart near center; interspaces unsculptured, shiny. Propodeal dorsum with ridges that are conspicuous basally and gradually evanescent posterad (interspaces punctate), with glabrous median sulcus that is crossed by several carinae but has no median carina; side punctate; posterior surface punctate and ridged (except for median sulcus). Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular. Horizontal area of tergum I with punctures that are about 1–2 diameters apart; apical depression punctate except along hindmargin; anterior declivity concave.

Setae silvery, fully concealing integument on frons (up to midocellus) and clypeus (Fig. 107a); appressed on upper frons, postocellar area, and scutum; subappressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following: clypeus yellow (color largely concealed by setae), reddish brown along lobe ventral margin; scapal venter pale yellow; apical flagellomeres brown ventrally, and pronotal lobe pale yellow in holotype, nearly all black in paratype; apical depressions of terga partly reddish brown in holotype. Femora, tibiae, and tarsi reddish brown, forefemur largely black.

♀.— Inner lateral tooth of clypeal lamella ill defined. Antenna clavate (Fig. 107b). Orbital fovea ill defined, but narrower than half ocellocular distance, absent in paratype. Dorsal length of flagellomere I about 1.1 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX equal to 0.4 × apical width, of flagellomere X about 1.1× basal width. Forebasitarsus with six rake spines (with seven spines on one leg in holotype). Pygidial plate not concealing integument. Length 6.5–7.5 mm.

♂–Unknown.

Geographic distribution (Fig. 105).— Known from two localities in Western Australia.

Records.— Holotype: ♀, **AUSTRALIA: Western Australia**: Nilemah Station 50 mi. S Denham, 8–9 Oct 1969, H.E. Evans and R.W Matthews (MCZ). Paratype: **Western Australia**: near Miyaboolya Beach (via Carnarvon), 8–13 Sept 1981, L. Kelsey (1 ♀, ANIC).

Sericophorus littoralis Rayment

Figures 108–110.

Sericophorus littoralis Rayment, 1955a:35, ♀. Holotype: ♀, South Australia: Ardrossan (SAM), examined by O. Lomholdt and W. Pulawski.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:247 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus littoralis* has the upper frons and postocellar area with erect setae, a concave anterior declivity on tergum I, a black frons and vertex, the ocellocular distance equal to 1.2–1.3 × hindocellar width, and the propodeal side separated from the posterior surface by a series of oblique ridges (but no longitudinal ridge). The gastral terga either have a dark bluish or violet luster or (some specimens) are all black. The female can be recognized by the middle clypeal section that is slightly concave in at least the ventral third. The male has the outer tooth of the clypeal lamella sharp (Fig. 108b) and flagellomeres III-VI slightly expanded apicoventrally.

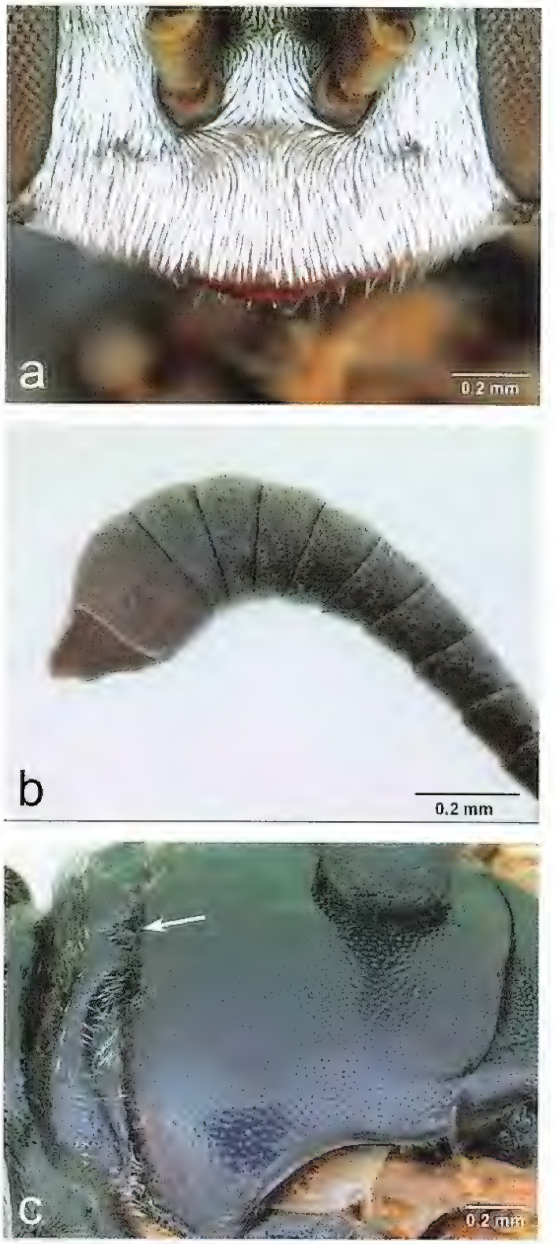

Figure 107. *Sericophorus lissonotus* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – female flagellum; c – female pronotal collar and scutum (the arrow show emargination in pronotal collar).

Description.— Frons swollen mesally, with shallow, inconspicuous punctures that are about 2–3 diameters apart at center; frontal line a low carina with narrow, unsculptured area above it; interocellar area convex adjacent to hindocellus, concave mesally. Antennal socket separated from

clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.2–1.3 × hindocellar width. Middle clypeal section concave ventrally, at least slightly so (up to about two thirds of length in female, up to about midlength in male). Scutal punctures about 2–3 diameters apart near center; scutal flange gradually narrowing toward apex. Mesopleural punctures about 1–4 diameters apart near center. Scutellum markedly convex. Propodeal dorsum punctate (punctures averaging about one diameter apart), in some specimens also with minute ridges, adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, glabrous, longitudinal sulcus; longitudinal sulcus indistinctly margined anteriorly, with a few transverse carinae; side microareolate, dull, with evanescent punctures (impunctate anteriorly), delimited from dorsum and posterior surface by series of short, conspicuous, oblique ridges (but no longitudinal ridge); posterior surface dull, microsculptured, with ill-defined ridges. Forewing vein M interstitial with cu-a; second submarginal cell conspicuously narrowed anteriorly. Horizontal area of tergum I with punctures that are about one diameter apart; anterior declivity concave.

Setae silvery on lower frons and clypeus, not concealing integument; erect on upper frons and postocellar area, on interocellar area as long as 0.8–0.9 × midocellar width, about 0.3 × midocellar width on scutum; inclined anterad on propodeal dorsum.

Head black except the following: middle clypeal section reddish brown (largely so in female, only ventrally in male), mandible reddish brown (dark brown apically); antenna reddish brown (apical flagellomere largely dark brown in female, flagellomeres VI-VIII of male black dorsally, flagellomeres IX and X all black). Pronotum black, pronotal lobe reddish posteriorly. Scutum and mesopleuron in many females with faint dark bluish or violet luster, black in male; scutellum black. Propodeum dark blue to violet. Legs dark reddish brown to light reddish brown. Gaster either with dark bluish or violet luster or all black; tergum I with faint reddish transverse band in some specimens; tergum VI in female, VI and VII in male, reddish.

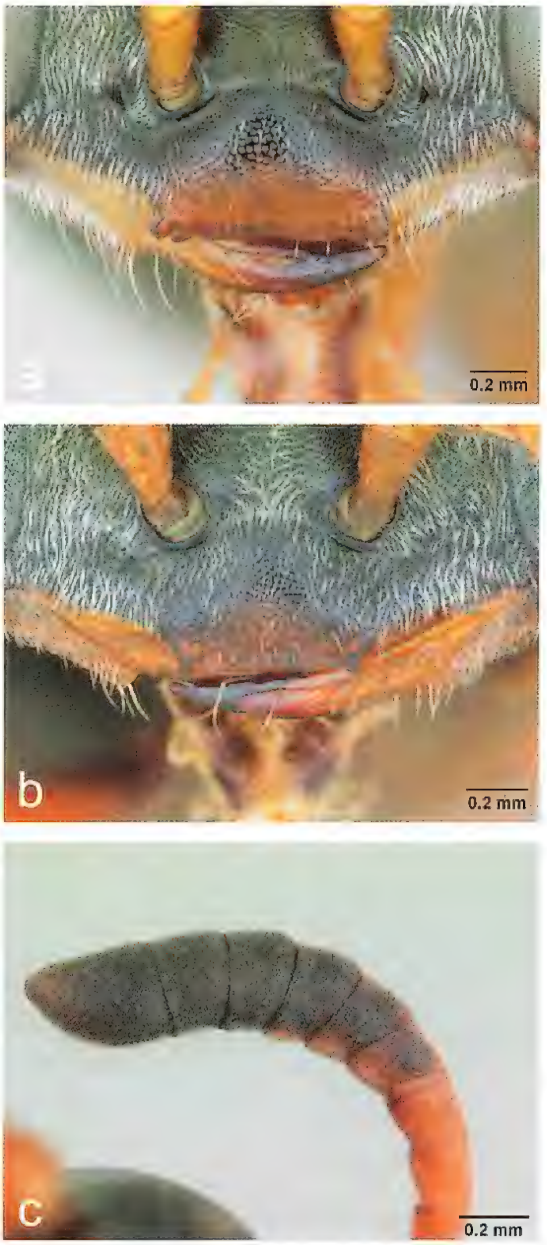

FIGURE 108. *Sericophorus littoralis* Rayment: a – female clypeus in frontal view; b – male clypeus in frontal view; c – male flagellum.

♀.— Orbital fovea rudimentary or absent. At least ventral third of middle clypeal section slightly concave; outer lateral tooth of lamella prominent or not prominent (Fig. 108a). Dorsal

length of flagellomere I 1.3–1.4 × apical width, of flagellomere II 1.1–1.3 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with seven or eight rake spines. Setae of pygidial plate not concealing integument except apically. Length 9.0–12.0 mm.

♂.— Clypeal lamella almost straight, with pointed lateral corner (Fig. 108b). Flagellomeres III-VI slightly expanded apicoventrally (Fig. 108c). Dorsal length of flagellomere I 1.3 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with five or six rake spines. Sternum VIII emarginate apically (Fig. 109a). Genitalia: Fig. 109b. Length 7.0–9.0 mm.

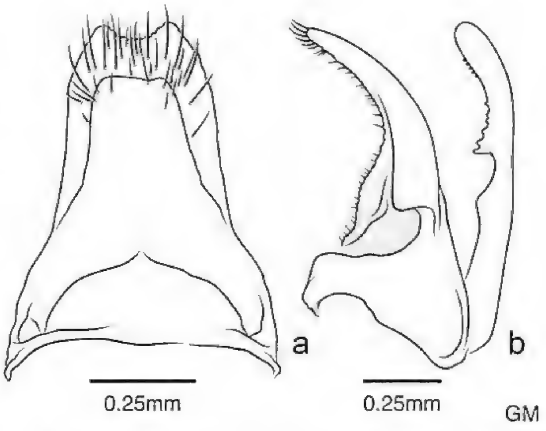

FIGURE 109. *Sericophorus littoralis* Rayment: a – male sternum VIII; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 110).— New South Wales, South Australia and Western Australia.

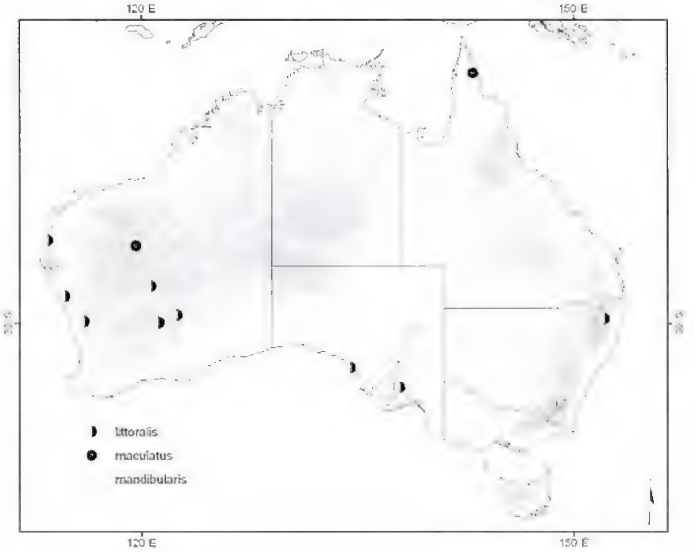

FIGURE 110. Collecting localities of *Sericophorus littoralis*, *maculatus*, and *mandibularis*.

RECORDS.— AUSTRALIA: New South Wales: Mann River Nature Reserve 12 mi. ESE Mount Windham, 1 Oct 1960 (1 ♀, ANIC). **South Australia**: Ardrossan, 27 Nov 1885 (1 ♀, SAM, holotype of *littoralis*); Mount Hall in Eyre Peninsula, 6 Dec 1968 (1 ♀, CAS). **Western Australia**: Coorow, 4 Nov 1958 (1 ♀, 1 ♂, ANIC; 1 ♀, 1 ♂, CAS); Kathleen Valley at 27°24′S 120°39′E, 1965 (1 ♀, WAMP); Goongarrie at 29°55′S 121°08′E, Oct 1980 (4 ♀, CAS, 14 ♀, 3 ♂, WAMP); Goongarrie at 29°54′S 121°10′E, *Casuarina* woodland, Oct 1980 (1 ♂, WAMP); Goongarrie at 29°55′S 121°14′E, Oct 1980 (1 ♂, WAMP); 30 km N Northampton, 7 Sept 1981 (1 ♂, AMS); Quobba Station in Cape Cuvier at 24°13′S 113°30′E, 30 May–24 Aug 1995 (1 ♀, WAMP); Yundamindra at 29°24′S 122°28′E, Oct 1980 (1 ♀, WAMP).

***Sericophorus maculatus* Pulawski, sp. nov.**
Figures 110, 111.

NAME DERIVATION.— *Maculatus*, Latin masculine adjective meaning *maculated*, with reference to the yellow scutellum contrasting with the remaining mainly black thorax.

RECOGNITION.— This species has appressed setae on the upper frons and postocellar area and can be recognized by its coloration (Fig. 111a): the thorax is black except the pronotal collar, pronotal lobe, and scutellum are pale yellow, and at least gastral terga I and II are reddish brown

FIGURE 111. *Sericophorus maculatus* Pulawski, sp. nov.: a – female body in lateral view; b – female clypeus in frontal view.

(gaster all reddish brown in many specimens), without yellow markings. Additional recognition features include: flagellum either reddish brown or yellowish brown dorsally, yellowish brown ventrally, ocellocular distance equal to 0.6 × hindocellar width, pronotal collar pale yellow, reaching level of scutum, metanotum black, propodeal dorsum finely ridged (ridges evanescent near posterior margin).

DESCRIPTION.— Frontal punctures ill defined, about one diameter apart. Frontal line not extending above frontal midheight. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.6–0.7 × hindocellar width. Interocellar area slightly convex adjacent to hindocellus, slightly concave mesally. Middle clypeal section with narrow glabrous zone adjacent to lamella. Scutal punctures varying from about one diameter apart to about 2–3 diameters apart; scutal flange ending almost abruptly. Mesopleural punctures averaging about one diameter apart in most specimens, but 3–4 diameters apart at center in female from Western Australia; interspaces unsculptured, shiny; episternal sulcus barely foveolate. Propodeal dorsum largely ridged (ridges evanescent near posterior margin), unsculptured apicomesally, with median carina in shallow depression; side shiny, with sparse, microscopic punctures, in specimen from Western Australia separated from posterior surface by minute, oblique ridges; posterior surface ridged (except for median sulcus), unsculptured and shiny mesodorsally. Forewing vein M interstitial with cu-a; second submarginal cell narrowly open at radial margin. Horizontal area of tergum I with punctures that average about two or three diameters apart; apical depressions of terga I and II impunctate.

Setae of lower frons and clypeus silvery, largely obscuring integument; appressed on upper frons, postocellar area, and scutum; oriented anterad on propodeal dorsum (dorsum largely glabrous mesally.

Head, thorax, and propodeum black except the following: clypeus yellowish ventrally orbit to orbit in specimen from Western Australia (only on median lobe in those from Queensland), scape and pedicel yellow, flagellum yellowish brown or reddish brown (yellowish ventrally), mandible yellow (brown apically), pronotal collar, pronotal lobe apically, and scutellum pale yellow. Mid- and hindcoxae, femora, tibiae, and tarsi yellow, mid- and hindtibiae partly brownish in specimen from Western Australia. Gaster all reddish brown in specimens from Queensland, in this from Western Australia terga II-V black, reddish brown apicomedially.

♀.— Orbital fovea not differentiated. Free margin of clypeal lobe arcuate (Fig. 111b). Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 0.8 × apical width; greatest length of

flagellomere IX 0.6 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with five to seven rake spines. Setae of pygidial plate not concealing integument except apically. Length 4.5–5.2 mm.

♂.— Unknown.

Geographic distribution (Fig. 110).— Known from one locality in northern Queensland and one in Western Australia.

Records.— Holotype: ♀, **AUSTRALIA**: **Queensland**: 13 km SE Weipa at 12°40'S 143°00'E, 11 Dec 1992–17 Jan 1993, P. Zborowski (ANIC). Paratypes: **AUSTRALIA**: **Queensland**: same data as holotype but 15 Nov –16 Dec 1993 (1 ♀, CAS); same data but 16 Dec 1993–16 Jan 1994, P. Zborowski and D. Khalu (4 ♀, ANIC; 2 ♀, CAS). **Western Australia**: 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8'S 117°36.8'E [correctly: 119°36.8'E], 7–18 May 2003, F.D. Parker and M.E. Irwin (1 ♀, ANIC).

***Sericophorus mandibularis* Lomholdt, sp. nov.**

Figures 110, 112, 113.

Name derivation.— *Mandibularis*, Latin adjective derived from *mandibula*, a mandible, which is unusually expanded in this species.

Recognition.— The male of *mandibularis* (the female is unknown) is instantly recognized by the posterior mandibular margin markedly convex between the base and notch (Fig. 112c) in combination with a mesally elevated clypeus (Fig. 112a, b). Subsidiary recognition features are: scutellum and gastral base reddish brown, metanotum pale yellow.

Description (based on holotype only).— Frons swollen near center; frontal punctures shallow, less than one diameter apart; interspaces microareolate, somewhat shiny; frontal line well defined, shiny. Ocellocular distance equal to 0.5 × hindocellar width. Orbital fovea wider than half ocellocular distance, matt, contrasting with adjacent areas. Clypeus with median elevation whose ventral portion is triangular, largely impunctate, glabrous (Fig. 112a, b). Posterior mandibular margin markedly convex between base and notch (Fig. 112c). Propleuron somewhat expanded posterolaterally. Scutal punctures on disk about one diameter apart; interspaces microsculptured; scutal flange ending abruptly. Mesopleural punctures up to about two diameters apart near center; interspaces shiny. Propodeal dorsum punctate, foveolate adjacent to anterior margin, with median sulcus that contains longitudinal carina; side and posterior surface (except for median sulcus) punctate. Forewing vein M diverging from M+Cu basad of but close to cu-a; second submarginal cell triangular. Horizontal area of tergum I with punctures that average about one diameter apart.

Setae with golden tinge on frons, concealing integument in ventral half adjacent to orbit and on clypeus laterally; appressed on upper frons, postocellar area, and scutum; nearly appressed, oriented anterad on propodeal dorsum.

Head, thorax, and propodeum black except the following: clypeal elevation reddish brown; antenna reddish brown (pedicel and flagellomere X brown); mandible pale yellow basally, brown apically; pronotal collar pale yellow; pronotal lobe brown; scutellum reddish brown; metanotum pale yellow, lateral portion of metanotum reddish brown. Legs light reddish brown except the following are pale yellow: forefemoral venter (except basally), foretibial outer surface (except apically), and small apical spot on midfemoral posterior surface. Gastral segment I reddish brown, segment II black, partly reddish brown, remaining segments black, apical depressions of terga translucent.

♀.— Unknown.

♂.— Clypeal lamella straight, without lateral tooth. Flagellomeres III-VIII with short, erect setae ventrally; flagellomere III angulate apically, flagellomeres IV and V convex ventrally; dorsal length of flagellomere I 0.9 × apical width (ventral length smaller than apical width), that of fla-

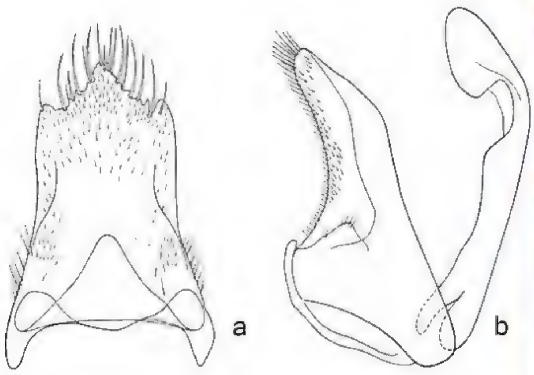

FIGURE 113. *Sericophorus mandibularis* Lomholdt, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view.

gellomere II 1.0 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with six rake spines. Sternum VIII: Fig. 113a. Genitalia: Fig. 113b0. Length 7.2 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 110).— Known from one locality in the northern part of Northern Territory.

RECORDS.— HOLOTYPE: ♂, **AUSTRALIA: Northern Territory**: 19 km NE Mount Cahill in Kakadu National Park at 12°50′S 132°52′E, 18 Nov 1972, J.C. Cardale (ANIC).

Sericophorus mesopleuralis Pulawski, sp. nov.

Figures 114, 115.

NAME DERIVATION.— *Mesopleuralis*, a Neolatin adjective derived from *mesopleuron*.

RECOGNITION.— The setae of *mesopleuralis* are erect on the upper frons and postocellar area and suberect on the scutum, the propodeal side is separated from the posterior surface by a zigzagging, longitudinal carina that intersects oblique ridges, and the head, thorax, propodeum, and gaster are black (gastral segments VI and VI bright reddish brown), whereas most of the femora and tibiae are bright reddish brown. Several species are similar, but they all have the mesopleuron and scutum punctate, while in *mesopleuralis* the mesopleuron is ridged (longitudinally on the episternal area, obliquely beneath the scrobe) and the scutum is finely, transversely ridged.

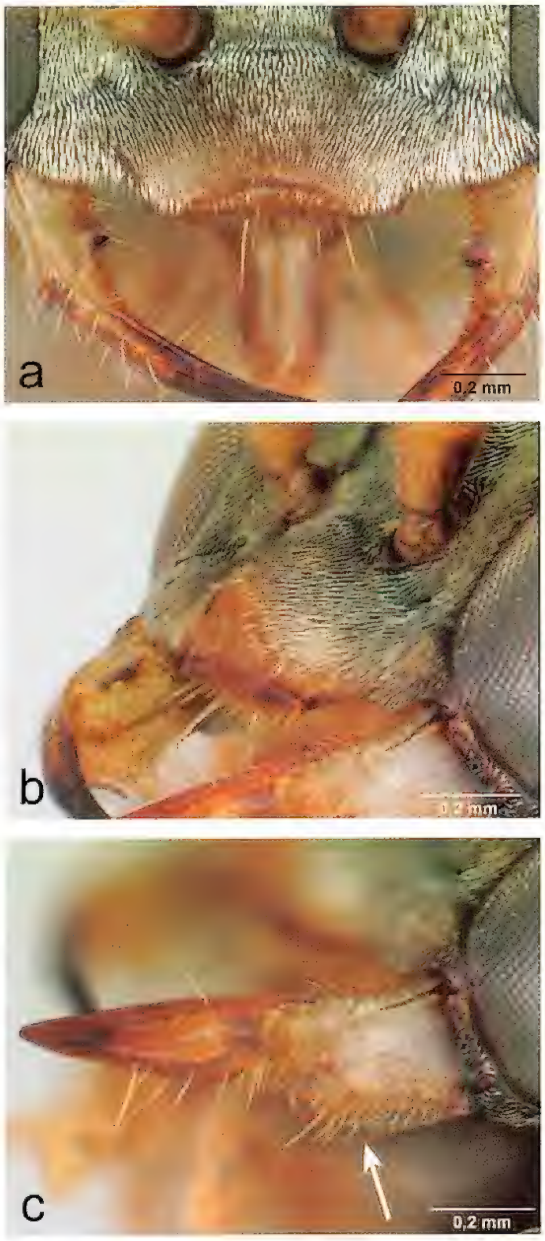

FIGURE 112. *Sericophorus mandibularis* Lomholdt, sp. nov.: a – male clypeus in frontal view; b – male clypeus in lateral oblique view; c – outer surface of male mandible (arrow indicates convex portion of posterior margin).

DESCRIPTION (based on holotype only).— Head unusually wide (Fig. 114a), its maximum width 1.3 × maximum height (measured from clypeus ventral margin to top of vertex). Frontal

punctures averaging more than one diameter apart. Frontal line extending to midocellus. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.2 × hindocellar width. Interocellar area convex adjacent to hindocellus, concave mesally. Clypeal lamella with prominent lateral tooth (Fig. 114b). Scutal punctures about one diameter apart at center, several diameters apart anteroadlaterally; many interspaces forming fine, transverse ridges; scutal flange gradually narrowing posterad; scutellum markedly convex. Mesopleuron obliquely ridged except episcrobal area longitudinally ridged (Fig. 114c); interspaces punctate. Propodeal dorsum punctate, adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, well-defined, glabrous, longitudinal sulcus; longitudinal sulcus contains longitudinal carina and a few transverse carinae; side ridged, separated from posterior surface by oblique ridges that are crossed by longitudinal, zigzagging carina; posterior surface punctate (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell narrowly open. Tergum I concave anteriorly, punctures of horizontal area averaging 2–3 diameters apart, but about one diameter apart adjacent to apical depression; apical depression punctate; apical depression of tergum II punctate except unsculptured along hindmargin.

Setae of lower frons and clypeus silvery, not obscuring integument; erect on upper frons, postocellar area, and scutum; on interocellar area about as long as 1.1 × midocellar width; on scutum suberect, about 0.8 × as long as midocellar width; suberect, oriented anterad on propodeal dorsum.

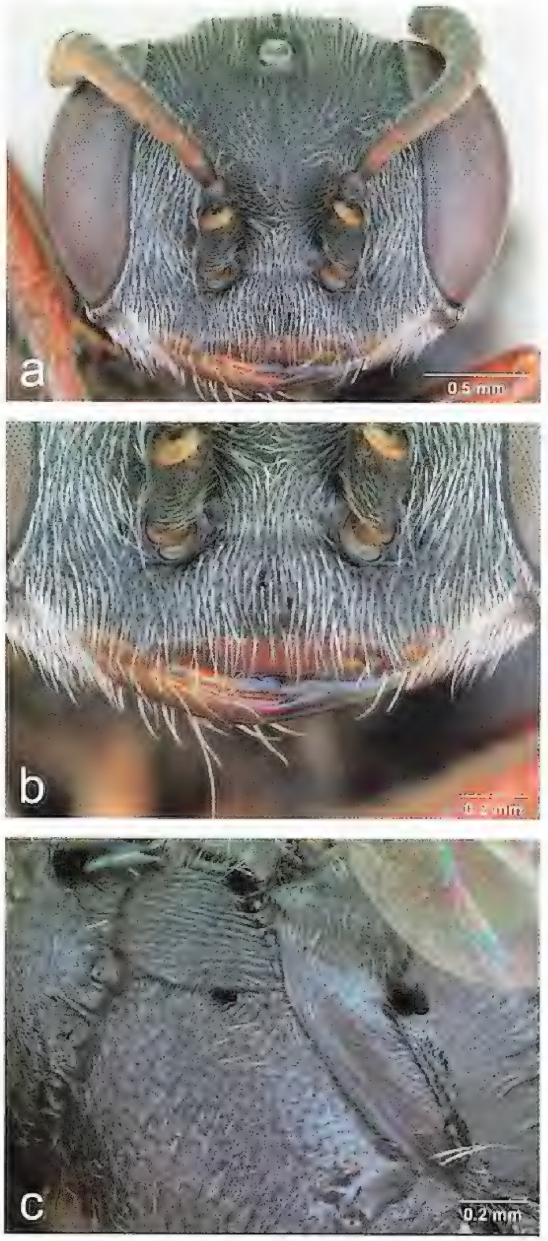

FIGURE 114. *Sericophorus mesopleuralis* Pulawski, sp. nov.: a – female head in frontal view; b – female clypeus in frontal view; c – female mesopleuron in lateral view.

Head, thorax, propodeum, and gaster black except flagellum brown ventrally, mandible yellowish basally and brown apically, and gastral segments V and VI bright reddish brown. Femora and tibiae bright reddish brown (forefemur black basally), tarsi partly brown.

♀.— Orbital fovea ill defined, wider than half ocellocular distance. Dorsal length of flagellomere I 1.3 × apical width, of flagellomere II 1.1 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with five rake spines. Setae of pygidial plate not concealing integument. Length 7.3 mm.

♂.— Unknown.

Geographic distribution (Fig. 115).— Known from one locality in Western Australia.

Records.— Holotype: ♀, **AUSTRALIA: Western Australia:** 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 7–18 May 2003, F.D. Parker and M.E. Irwin (ANIC).

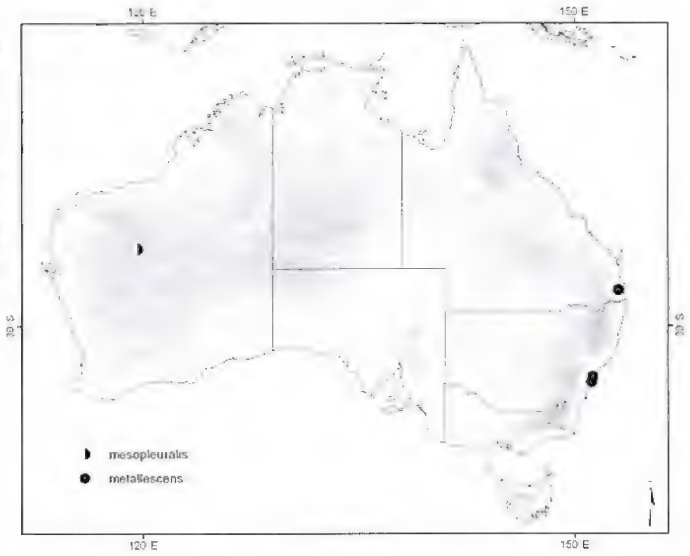

Figure 115. Collecting localities of *Sericophorus mesopleuralis* and *metallescens*.

Sericophorus metallescens Rayment

Figures 115–117.

Sericophorus metallescens Rayment, 1955a:36, ♂. Holotype: ♂, Australia: New South Wales: Fraser Park (NMV), examined by O. Lomholdt.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:247 (in catalog of Australian Sphecidae).

Sericophorus patongensis Rayment, 1955a:39, ♀. Holotype: ♀, Australia: New South Wales: Patonga (AMS), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:248 (in catalog of Australian Sphecidae).

Sericophorus rugosus Rayment, 1955a:48, ♀. Holotype: ♀, Australia: Queensland: Brisbane (QMB), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:249 (in catalog of Australian Sphecidae).

Recognition.— Similar to *aliceae*. See the latter species for differences (p. 33).

Description.— Frontal punctures minute, somewhat ill defined, about two diameters apart below midocellus; frontal line reaching midocellus. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.0 × hindocellar width in female, 0.9 × in male. Scutal punctures minute, averaging about two diameters apart at center; scutal flange gradually narrowing posterad; admedian line deeply impressed; notaulus with inconspicuous, transverse ridges. Mesopleural punctures near center about 2–3 diameters apart. Propodeal dorsum conspicuously, irregularly ridged, punctate between ridges, with distinctly margined median sulcus (sulcus crossed by a few transverse ridges, without median carina); side microareolate, with sparse punctures, separated from posterior surface by longitudinal ridge that is crossed by several oblique ridges; posterior surface with transverse ridges and minute punctures (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly. Horizontal area of tergum I with punctures that are about two diameters apart mesally; anterior declivity of tergum I concave.

Setae silvery, not concealing integument on lower frons and clypeus; erect on upper frons and

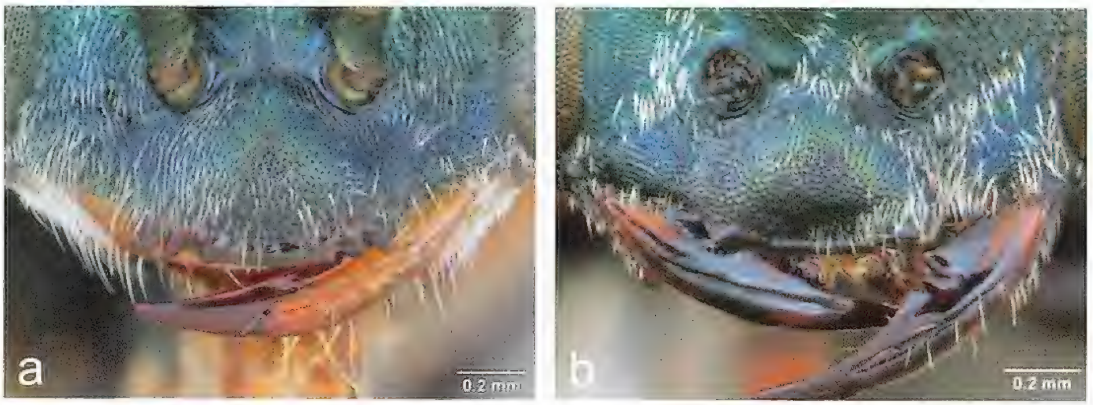

FIGURE 116. *Sericophorus metallescens* Rayment: a – female clypeus in frontal view; b – male clypeus in frontal view.

postocellar area, on interocellar area about as long as 0.8 × midocellar width; erect on scutum and propodeal dorsum.

Head, thorax, propodeum, femora, and gaster metallic green except mandible yellow basally and dark brown apically, pronotal lobe brownish, female flagellum brown ventrally, and female gastral segment VI black. Tibiae and tarsi black except apical tarsomeres and female foretibia reddish brown.

♀.— Orbital fovea black, less than half ocellocular distance. Free margin of clypeal lobe almost straight (Fig. 116a). Dorsal length of flagellomere I 1.3 × apical width, of flagellomere II 1.4 × apical width; greatest length of flagellomere IX 0.8 × apical width; flagellomere X missing in specimens examined. Forebasitarsus with five to seven rake spines. Setae of pygidial plate not obscuring integument. Length 8.0–8.5 mm.

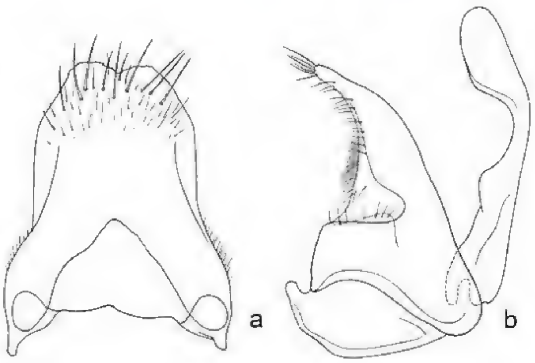

FIGURE 117. *Sericophorus metallescens* Rayment: a – male sternum VIII; b – male genitalia in lateral view.

♂.— Lateral margin of clypeal lamella acutely angulate (Fig. 116b). Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 1.2 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.1 × basal width. Forebasitarsus with five rake spines. Sternum VIII slightly emarginate apically (Fig. 117a). Genitalia: Fig. 117b. Length about 8.0 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 115).— New South Wales, southeastern Queensland.

RECORDS.— **AUSTRALIA**: **New South Wales**: Fraser Park, 16 Dec 1947 (1 ♂, NMV, holotype of *metallescens*); Patonga, 9 Mar 1947 (1 ♀, AMS, holotype of *patongensis*). **Queensland**: Brisbane, 3 Oct 1916 (1 ♂, QMB), 10 Oct 1916 (1 ♀, QMB, holotype of *rugosus*).

***Sericophorus mimus* Pulawski, sp. nov.**
Figures 118–120.

NAME DERIVATION.— Mimus, Latin for mime; a noun in apposition to the generic name; with reference to this species similarity to *rufoniger*.

RECOGNITION.— Like *rufoniger*, *mimus* has at least the scutum reddish brown (also the pronotum and the propodeum in most specimens), whereas the scutellum, metanotum, mesothoracic ven-

ter, and gaster are black. Also, the pronotum of these two species is longer than in the other congeners (see Fig. 176d). Unlike *rufoniger*, the clypeus, mesopleuron, and forecoxal venter of *mimus* are all black, whereas the femora, tibiae, and tarsi are reddish brown; in the male, the greatest length of flagellomere IX is about 0.5 × apical width. In *rufoniger*, the clypeus is yellow, the mesopleuron is reddish brown (all or largely so), the forecoxal venter is pale yellow or reddish brown, the fore- and midfemora have a pale yellow apical spot, and the hindtibia is pale yellow dorsally (at least partly so); in the male, the greatest length of flagellomere IX is about 1.0 × apical width.

Similar unassigned specimens.— Four females and two males coming from the same general area as *mimus* closely resemble both this species and *rufoniger*. In particular, their clypeus is black (as in *mimus*), the fore- and midfemora have a pale yellow apicoventral spot (as in *rufoniger*), the tibiae are reddish brown (as in *mimus*), with an ill-defined dorsal spot on the hindtibia in most specimens (as in *rufoniger*), but the spot is absent in one female (as in *mimus*), the mesopleuron largely reddish brown (as in *rufoniger*), and the maximum length of male flagellomere IX is 0.9 × its apical width (close to that of *rufoniger*). The status of these specimens in unclear. They have been collected in Western Australia, 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003, F.D. Parker and M.E. Irwin (1 ♀, ANIC; 1 ♀, CAS, 1 ♀, USU), and 10 km W Cobra Station at 24°10.2′S 116°23.0′E, 21 Apr–10 May 2003, F.D. Parker and M.E. Irwin (1 ♂, ANIC; 1 ♂, USU).

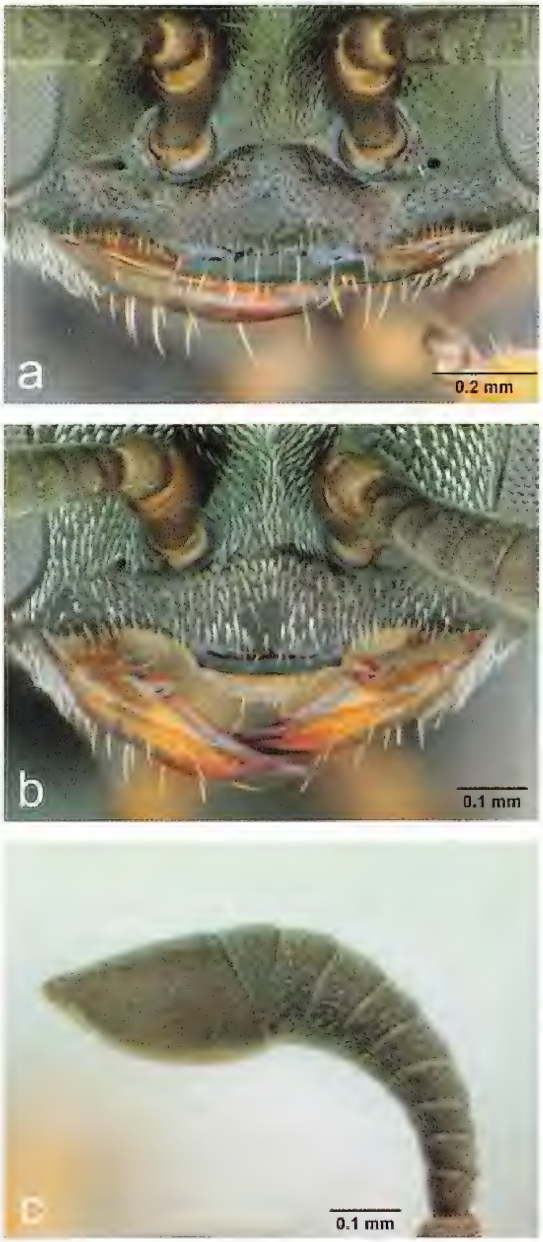

FIGURE 118. *Sericophorus mimus* Pulawski, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view; c – male flagellum.

Description.— Frontal punctures shallow, inconspicuous, about one diameter apart. Frontal line present in frons ventral half, evanescent or absent in dorsal half. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.5 × hindocellar width. Clypeal lamella straight or nearly so. Scutal punctures averaging about one diameter apart (some 2–3 diameters apart); scutal flange ending abruptly. Mesopleural punctures about 2–3 diameters apart at center, interspaces unsculptured, shiny. Propodeal dorsum minutely punctate, with conspicuous, longitudinal ridges adjacent to front margin, with median carina, largely glabrous apicomesally; side largely unsculp-

tured or minutely microsculptured; posterior surface minutely punctate except for median sulcus. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular or minimally open anteriorly. Tergum I concave at very base, punctures of horizontal area minute, several diameters apart; apical depression largely impunctate; apical depression of tergum II largely impunctate mesally.

Setae of lower frons and clypeus with golden tinge in female, silvery in male, not obscuring integument; appressed on upper frons, postocellar area, and scutum; nearly appressed, oriented anterad on propodeal dorsum.

Head black, flagellum all black or partly brown, mandible black or yellow basally, reddish preapically. Pronotum, scutum, and most of propodeum reddish brown in most specimens (scutellum and metanotum contrastingly black, pronotal lobe yellow), but pronotum and propodeum largely blackish and scutum darkened in some (particularly males); mesopleuron and mesothoracic venter black. Gaster black, apical depressions of terga brown. Femora, tibiae, and tarsi reddish brown.

♀.— Width of orbital fovea more than half ocellocular distance posteriorly. Clypeal lamella with two lateral teeth on each side in some specimens, but teeth partly or completely fused on one or both sides in other specimens (Fig. 118a). Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with five to seven rake spines. Setae of pygidial plate not concealing integument. Length 4.6–5.8 mm.

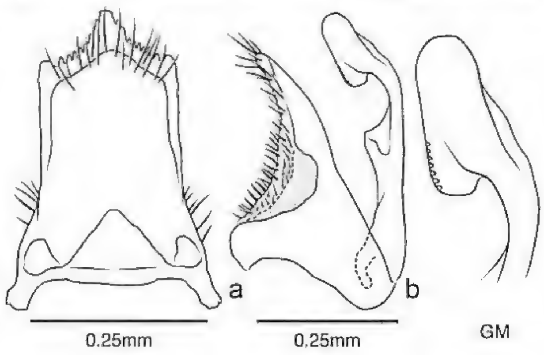

FIGURE 119. *Sericophorus mimus* Pulawski, sp. nov.: a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

♂.— Clypeal lamella angulate laterally (Fig. 118b). Flagellum clavate (Fig. 118c); dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.5 × apical width, of flagellomere X 1.8–2.00 × basal width (shorter in small specimens). Forebasitarsus with four or five rake spines. Sternum VIII with apicomedian point (Fig. 119a). Genitalia: Fig. 119b. Length 3.0–4.5 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 120).— Northern Territory, Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Western Australia**: 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003, F.D. Parker and

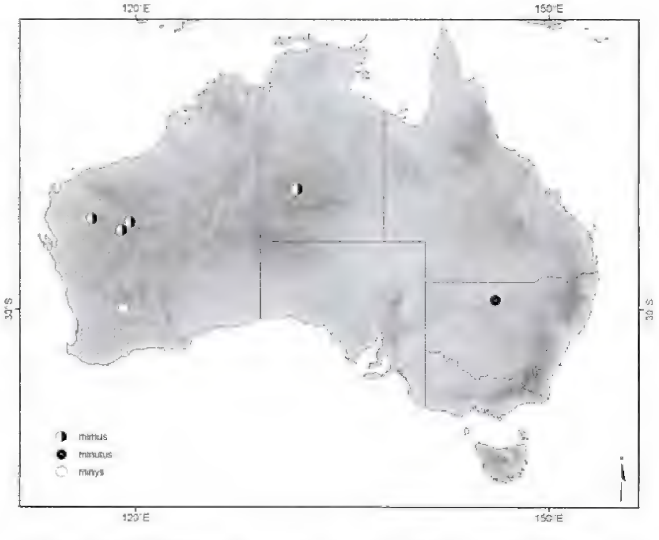

FIGURE 120. Collecting localities of *Sericophorus mimus*, *minutus*, and *minys*.

M.E. Irwin (ANIC). PARATYPES: **Northern Territory:** Yuendumu at 22°15′S 131°47′E, 5 Oct, year and collector not indicated (1 ♀, AEI). **Western Australia**: same data as holotype (1 ♀, 5 ♂, ANIC; 1 ♀, 3 ♂, CAS; 1 ♀, 3 ♂, USU); Mount Augustus National Park at 24°21.7′S 116°50.2′E, 25 Apr 2001, F.D. Parker and M.E. Irwin (1 ♂, ANIC); 30 km ESE Three Rivers at 25°13.6′S 118°56.9′E, M.E. Irwin and F.D. Parker (1 ♀, ANIC; 1 ♀, CAS; 1 ♀, USU).

Sericophorus minutus Rayment

Figures 120–122.

Sericophorus minutus Rayment, 1955a:37, ♂. Holotype: ♂, Australia: New South Wales: 20 mi. SE Bourke (ANIC), examined by O. Lomholdt and W. Pulawski.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:248 (in catalog of Australian Sphecidae).

RECOGNITION.— The male of *Sericophorus minutus* is small (length about 5.0 mm), with the head, thorax, propodeum, and gaster metallic blue, and the femora, tibiae, and tarsi contrastingly reddish brown, setae erect on the upper frons and postocellar area, and the propodeal dorsum finely rugose on each side of the median sulcus. Additionally, the apical depressions of terga are impunctate. The female is unknown.

FIGURE 121. *Sericophorus minutus* Rayment: male clypeus.

DESCRIPTION (based on holotype only).— Inner orbits practically parallel (except ventrally). Frontal punctures averaging about one diameter apart; frontal line a black, unsculptured stripe ending well below midocellus. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to hindocellar width. Scutal punctures more than one diameter apart at center; scutal flange gradually narrowing toward apex. Mesopleural punctures near center up to 2–3 diameters apart. Propodeal dorsum adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, well-defined, glabrous, longitudinal sulcus; longitudinal sulcus with a few transverse ridges; integument finely rugose on each side of sulcus; side irregularly microsculptured, separated from posterior surface by oblique ridges that are crossed by zigzagging longitudinal ridge; posterior surface rugose (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell triangular. Tergum I with minute punctures that are up to several diameters apart at center of horizontal area preapically, and with microareolate, dull interspaces; anterior declivity of tergum I concave. Apical depressions of terga impunctate, microsculptured.

Setae on lower frons laterally and on lateral clypeal section appressed, silvery, largely concealing integument; on upper frons and postocellar area erect, on interocellar area about 0.6 × as long as midocellar width; on scutum silvery, suberect, about as long as 0.3 of midocellar width; on propodeal dorsum suberect.

Head, thorax, propodeum, and gaster metallic blue, with the following exceptions: scape and pedicel brown, flagellum reddish brown, slightly darkened dorsally; mandible black basally and apically, dark reddish mesally; pronotal lobe reddish. Wing veins pale yellow, submarginal vein light brown. Femora, tibiae, and tarsi yellowish reddish, forefemur dark basally. Apical depressions of terga reddish brown, translucent.

♀.— Unknown.

♂.— Orbital fovea flat, black (contrasting in color with adjacent integument), slightly wider than half ocellocular distance. Lateral corner of clypeal lamella sharply angulate (Fig. 121). Dorsal length of flagellomeres I and II 0.8 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.0 × basal width. Forebasitarsus with four rake spines. Terminal four gastral segments missing in holotype. Sternum VIII: distal margin evenly rounded (Fig. 122a); after Rayment, 1955a:99, plate 10, Fig. 18). Genitalia: Fig. 122b. Length about 5.0 mm.

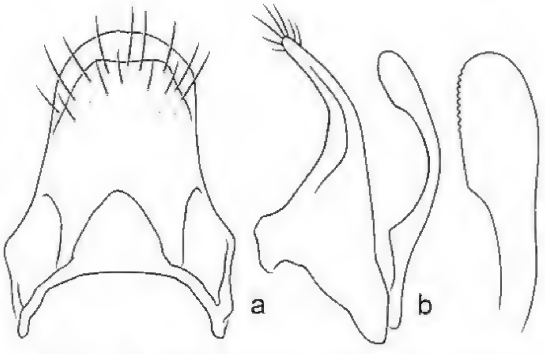

FIGURE 122. *Sericophorus minutus* Rayment (redrawn from Rayment, 1955, plate 10, figs. 17, 18, 99): a – male sternum VIII; b – male genitalia in lateral view, with outline of penis valve.

GEOGRAPHIC DISTRIBUTION (Fig. 120).— Known from one locality in New South Wales.

RECORDS.— **AUSTRALIA**: **New South Wales**: 20 mi. SE Bourke, 27 Oct 1949 (1 ♂, ANIC, holotype of *minutus*).

***Sericophorus minys* Pulawski, sp. nov.**
Figures 120, 123, 124.

NAME DERIVATION.— *Minys*, Greek for *little, small, short.*

RECOGNITION.— Like *froggatti*, *funebris*, and *halli*, *minys* is characterized by the presence of a sublateral carina on the propodeal dorsum. It differs from these species in having a large unsculptured and glabrous area above each antennal socket (Fig. 123a, b) rather than frons fully punctate and setose, a rugose propodeal dorsum (Fig. 123c) rather than ridged and punctate, an unsculptured dorsomedian area of the posterior propodeal surface (rather than sculptured), the free margin of the middle clypeal section in the male with two lateral teeth (rather than one), and the apical rake spine of male forebasitarsus equal to 1.3 × apical basitarsus width (rather than slightly shorter).

DESCRIPTION (based on holotype only).— Head transverse in frontal view (Fig. 123a), its maximum width 1.35 × maximum height (measured from clypeus ventral margin to top of vertex). Inner orbits nearly parallel (Fig. 123a). Most of frons punctate (punctures less than one diameter apart), with large unsculptured, glabrous area above each antennal scrobe (Fig. 123a, b). Frontal line reaching midocellus. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.2 × hindocellar width. Pronotal collar not reaching level of scutum. Scutal punctures about two diameters apart at center; scutal flange gradually narrowing posterad. Mesopleural punctures about two diameters apart near center, interspaces unsculptured. Propodeal dorsum rugose, with sublateral carina (Fig. 123c); side unsculptured, separated from posterior surface by zigzagging carina; posterior surface ridged, dorsomedian area unsculptured. Forewing vein M interstitial with M+Cu; second submarginal cell narrowly opened anteriorly. Tergum I concave anteriorly, punctures of horizontal area about two diameters apart; apical depression punctate except apically; apical depression of tergum II punctate except apically.

Setae of lower frons and clypeus silvery, largely obscuring integument (not obscuring middle clypeal section ventrally); suberect on upper frons; on interocellar area erect, about 0.4 × as long as midocellar width; on postocellar area suberect, about 0.3 × as long as midocellar width; on scutum suberect, about 0.2 × as long as midocellar width; nearly appressed, oriented anterad on propodeal dorsum.

FIGURE 123. *Sericophorus minys* Pulawski, sp. nov.: a – male head in frontal view (arrow indicates glabrous scapal basin); b – male clypeus in frontal view; c – propodeal dorsum of male in dorsal view.

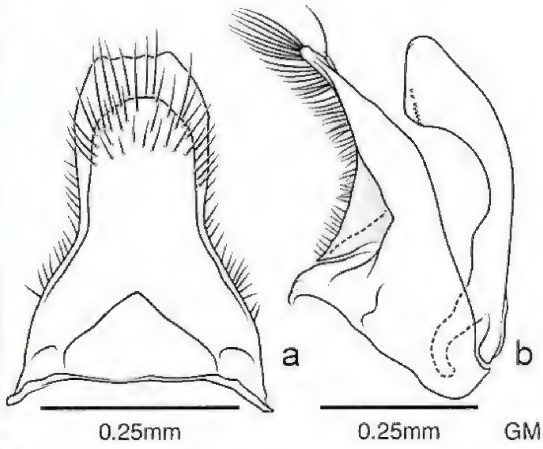

FIGURE 124. *Sericophorus minys* Pulawski, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view

Head, thorax, propodeum, and gaster black (including scape and pedicel), mandible pale yellow, brown apically. Femora black, pale yellow apically; tibiae and fore- and midbasitarsi pale yellow (except basitarsi brown apically); fore- and midbasitarsi and hindtarsus brown.

♀.— Unknown.

♂.— Free margin of middle clypeal section with two lateral teeth (inner tooth minute). Antennae missing except for left scape, pedicel, and flagellomere I (dorsal length of flagellomere I 1.2 × apical width). Forebasitarsus with five rake spines, apical spine as long as 1.3 × apical width of basitarsus. Sternum VIII almost truncate, slightly weaving apically (Fig. 124a). Genitalia: Fig. 124b. Length 4.3 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 120).— Known from one locality in Western Australia.

RECORDS.— HOLOTYPE: ♂, **AUSTRALIA: Western Australia**: 22 km N Bullfinch at 30°59′S 119°06′E, 2–3 Oct 1981, Terry F. Houston (WAMP).

Sericophorus multipictus Pulawski, sp. nov.

Figures 125–127.

NAME DERIVATION.— Derived from the Latin words *multus*, multiple, and *pictus*, painted; with reference to this species coloration.

Recognition.— Like *cardaleae, multipictus* has three longitudinal carinae on sternum I, but differs from that species in having an arcuate, well defined sulcus behind the carinae (a unique such character within the genus). Subsidiary recognition characters are: clypeal median section elevated, separated from the free margin by a glabrous, vertical area, free margins of both elevation and of lobe emarginate (emargination shallower than in *cardaleae*, Fig. 125a-d); propleuron prominently angulate posterolaterally; pronotum and metanotum pale yellow, and scutellum reddish brown.

Description.— Frontal punctures averaging less than one diameter apart; frontal line extending till midocellus, well defined up to frontal midheight. Ocellocular distance equal to 1.0–1.1 ×hindocellar width. Clypeal lamella broadly emarginate mesally, median lobe with elevation whose free margin is also broadly emarginate (insignificantly so in large males), with glabrous area between elevation free margin and lobe free margin (Fig. 125a-d); elevation overhanging lobe free margin in male; glabrous area short, oblique in female, markedly longer, concave in male. Propleuron prominently angulate posterolaterally (as in Fig. 165e). Scutal punctures averaging about one diameter apart near center; scutal flange ending abruptly. Mesopleural punctures about one diameter apart; interspaces unsculptured, shiny (integument largely concealed by vestiture). Propodeal dorsum minutely punctate (interspaces shiny), with shallow, narrow median impression that contains longitudinal carina; side punctate except unsculptured anteriorly; posterior surface punctate except for median sulcus. Forewing vein M diverging from M + Cu basad of cu-a; second submarginal cell triangular. Punctures of tergum I about 2–3 diameters apart on center of horizontal area; basolateral carina expanded but not elongate, ending before spiracle foremargin; apical depression

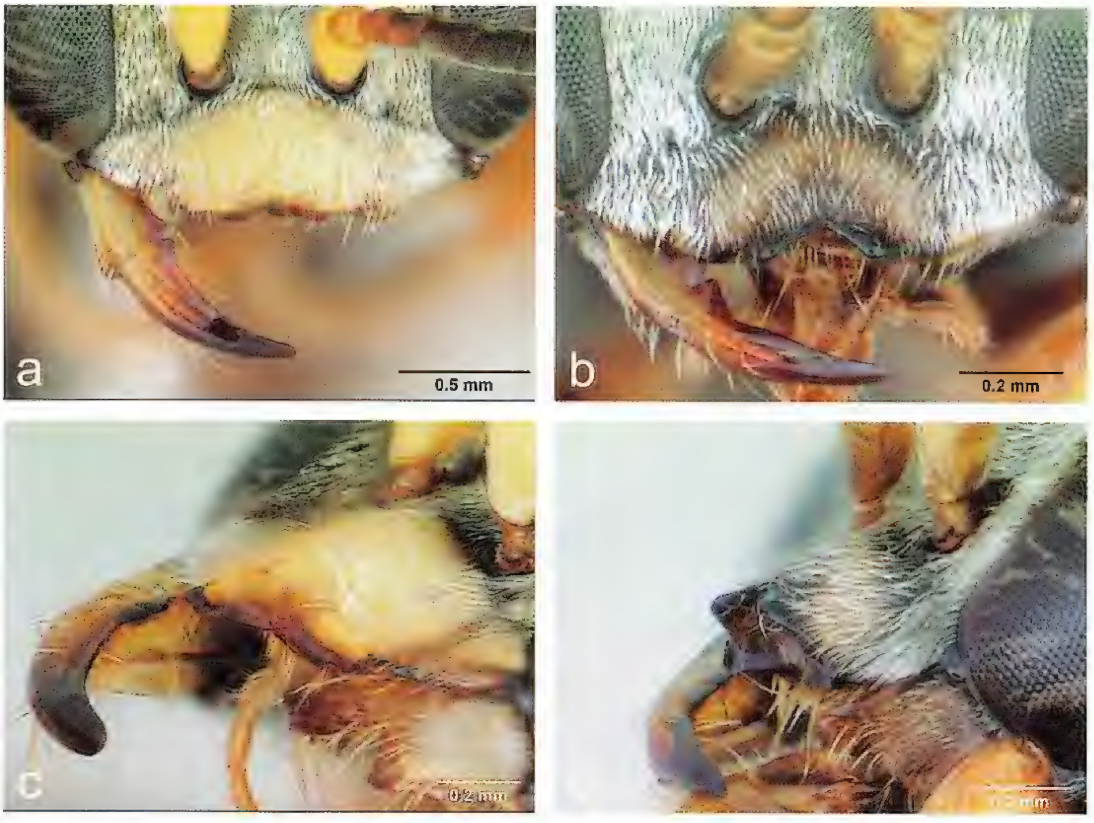

Figure 125. *Sericophorus multipictus* Pulawski, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female clypeus in lateral oblique view; d – male clypeus in lateral oblique view.

punctate. Sternum I thickened basally, with three longitudinal carinae on thickening, and with .arcuate, well-defined sulcus behind thickening.

Setae silvery, completely concealing integument on lower frons laterally and on lateral clypeal section; appressed on upper frons, postocellar area, and scutum; almost appressed, oriented anterad on propodeal dorsum.

Head black except the following are pale yellow: scape (largely brown in some specimens), pedicel (brown in some specimens), female clypeus, curved fascia on middle section of male clypeus, mandible basally (dark brown apically); flagellum black, reddish brown ventrally. Thorax and propodeum black except the following: pronotum pale yellow; pronotal lobe reddish brown, pale yellow apically; scutellum reddish brown; metanotum pale yellow. Forewing slightly infumate. Forefemur tricolored: reddish brown dorsally, pale yellow ventrally (except near base), black in-between on posterior surface; midfemur reddish brown, in most specimens pale yellow ventrally (except near base); hindfemur reddish brown; tibiae reddish brown, foretibia pale yellow on outer surface; tarsi varying from reddish brown to brown. Gaster black except median area of tergum I and apical tergum reddish brown (tergum I all reddish brown in specimen from Finniss River); terga II-V with translucent apical depressions, narrowly reddish brown before apical depressions.

♀.— Orbital fovea wider than half ocellocular distance. Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 1.1 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with 7–9 rake spines. Setae of pygidial plate largely obscuring integument preapically. Length 8.1–9.1 mm.

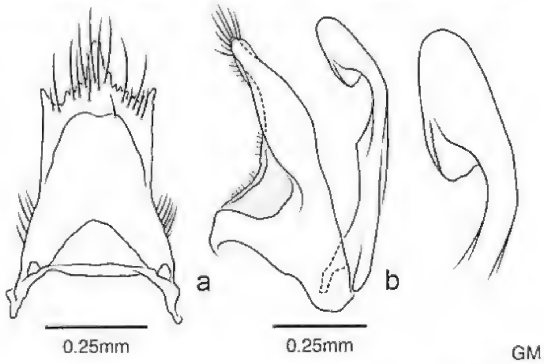

FIGURE 126. *Sericophorus multipictus* Pulawski, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view, with outline of penis valve.

♂.— Dorsal length of flagellomeres I 1.0 × apical width, of flagellomere II 1.1 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.5 × basal width; flagellomere II slightly concave ventrally, flagellomere III slightly concave ventrally except preapical tubercle. Forebasitarsus with 4–6 rake spines. Sternum VIII: Fig. 126a. Genitalia: Fig. 126b. Length 7.0–8.2 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 127).— Northern Queensland and northern part of Northern Territory.

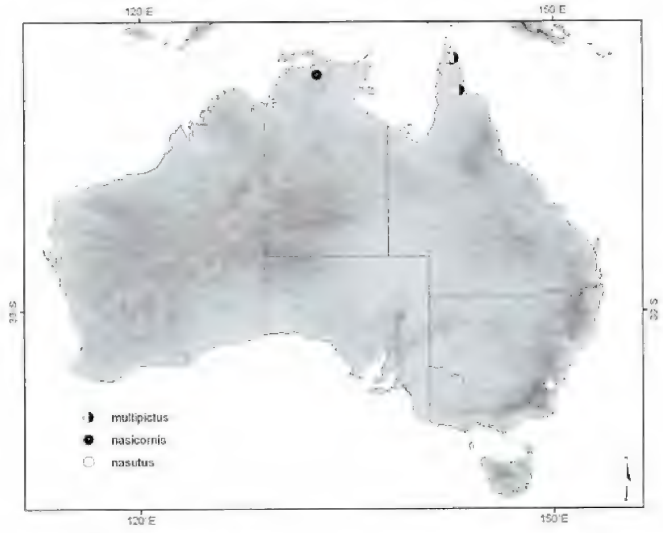

FIGURE 127. Collecting localities of *Sericophorus multipictus*, *nasicornis*, and *nasutus*.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Queensland:** Cock-

atoo Creek crossing 17 km NW Heathlands at 11°39′S 142°27′E, 22 Jan–19 Feb 1994, P. Zborowski (ANIC). PARATYPES: **AUSTRALIA**: **Northern Territory**: near Finniss River at 12°57′S 130°33′E, 19–25 May 1998, M. Hoskins (1 ♂, NTM). **Queensland**: Cape York Peninsula: Bertie Creek 1 km SE Heathlands Homestead at 11°45′S 142°35′E, 15 Mar 1992, G. Daniels and M.A. Schneider (1 ♀, CAS; 1 ♀, 1 ♂, UQIC); Cape York Peninsula: Captain Billy Landing Road 8 km N Bamaga junction at 11°38′S 142°44′E, 13 Mar 1992, G. Daniels and M.A. Schneider (1 ♀, UQIC); Cockatoo Creek crossing 17 km NW Heathlands at 11°39′S 142°27′E, 15–26 Jan 1992, I.D. Naumann and T. Weir (1 ♂, ANIC); same locality but P. Feehney, 26 Jan–29 Feb 1992 (4 ♀, 2 ♂, ANIC), 1–21 Mar 1992 (4 ♀, 2 ♂, ANIC; 3 ♀, CAS), and 22 Mar–25 Apr 1992 (2 ♀, ANIC); same locality but 22 Jan–19 Feb 1994, P. Zborowski (1 ♀, ANIC); Coen at 13°57′S 143°12′E, 13 Jan–25 Feb 1994, 13 Jan–25 Feb 1994, P. Zborowski and W. McKay (1 ♀, ANIC); Double Mouth Creek 30 km NE Heathlands Homestead at 11°37′S 142°48′E, 19 Mar 1992, G. Daniels and M.A. Schneider (1 ♂, CAS).

***Sericophorus nasicornis* Lomholdt, sp. nov.**
Figures 127, 128.

NAME DERIVATION.— *Nasicornis*, from Latin *nasus*, nose, and *cornu*, horn; with reference to the conspicuous clypeal prominence of this species.

RECOGNITION.— *Sericophorus nasicornis* has the spiracle of tergum I prominent apically, forming an angle with the tergum surface (similar to that of *cornutus*, and much smaller than in *rhinoceros* and *sericeus*). Also, the clypeus has a median elevation that is concave and glabrous ventrally, culminating in a conspicuous projection (Fig. 128a-c). The species differs from the other three in having an expanded basolateral carina of tergum I (Fig. 128e), the pronotal collar pale yellow laterally, and a black scutellum and metanotum.

DESCRIPTION (based on holotype only).— Frontal punctures minute, about one diameter apart; frontal line thin, extending slightly above frontal midheight. Ocellocular distance equal to 0.6 × ocellocular distance. Middle clypeal section elevated; ventral surface of elevation concave, glabrous; dorsal surface culminating in conspicuous projection (Fig.128a-c); free margin of clypeal lamella emarginate . Propleuron conspicuously prominent posterolaterally, prominence oriented anterad. Scutal punctures about one diameter apart; scutal flange gradually narrowing posterad. Mesopleural punctures two to three diameters apart near center; interspaces unsculptured. Metanotum with obtuse, median swelling (except apically). Propodeal dorsum finely punctate, with longitudinal ridges next to anterior margin, and glabrous, median depression that contains longitudinal carina, unsculptured apicomesally; side punctate, unsculptured anteriorly; posterior surface punctate (except for median sulcus), ridged near ventral margin. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell slightly truncate anteriorly. Tergum I with basolateral carina expanded, ending behind anterior margin of spiracle (Fig. 128e); spiracle prominent apically, forming an angle with tergum surface (similar to that of *cornutus*, much smaller than in *rhinoceros* and *sericeus*); horizontal area of tergum I with punctures that are several diameters apart mesally, apical depression nearly all impunctate. Sternum I with basal, ridged elevation that ends at about sternal midlength.

Setae silvery, concealing integument on lower half of frons laterally; appressed on upper frons, postocellar area, and scutum; subappressed, oriented anterad on propodeal dorsum.

Head, thorax, and propodeum black except the following: clypeus yellow, with reddish luster; antenna light reddish brown; mandible pale yellow basally, dark brown apically; pronotal collar pale yellow laterally; pronotal lobe with reddish tinge. Femora, tibiae, and tarsi reddish brown. Gaster reddish brown.

♀.— Orbital fovea absent. Clypeal lamella with two lateral teeth on each side (Fig. 128a).

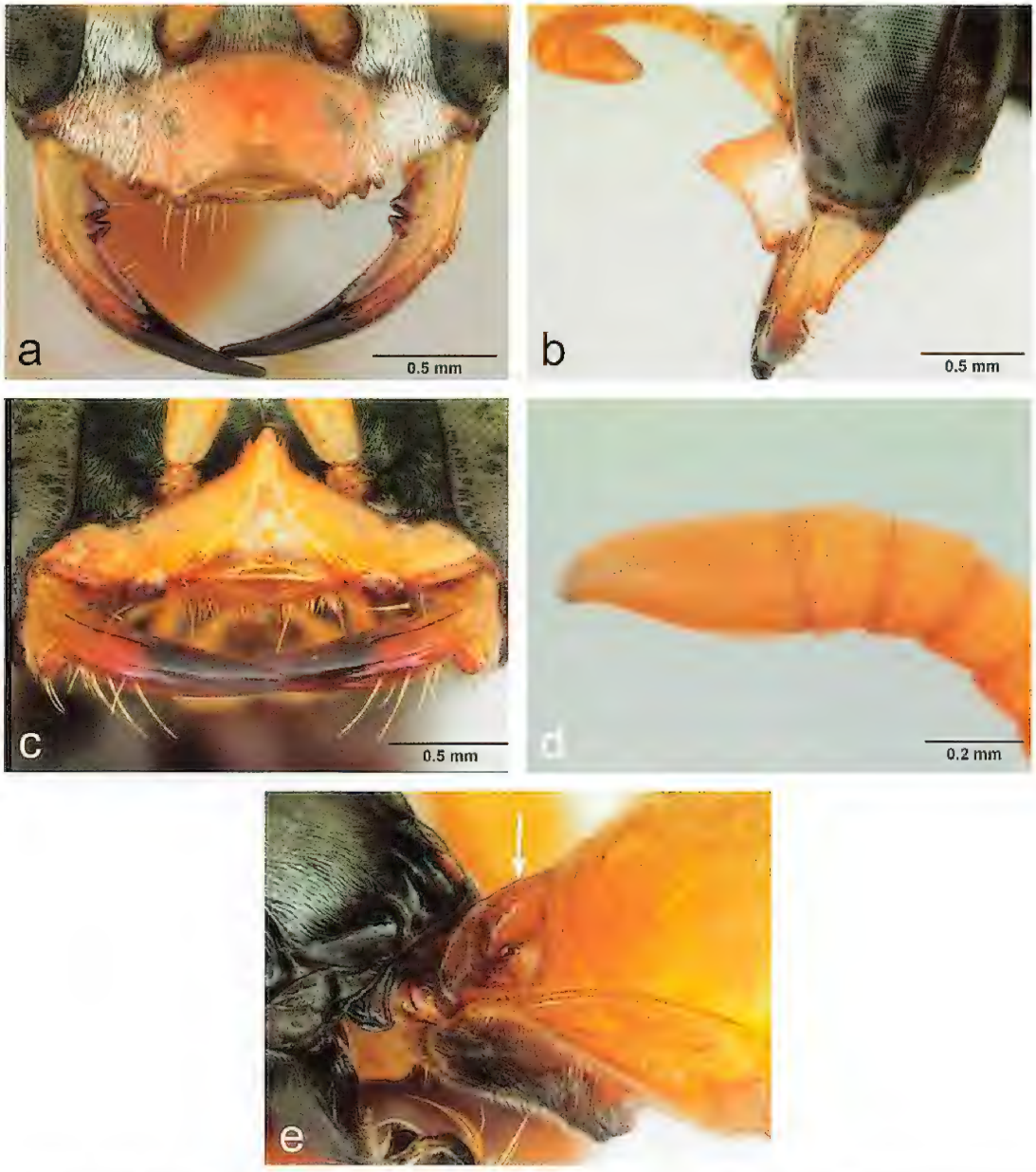

FIGURE 128. *Sericophorus nasicornis* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – female clypeus in lateral view; c – female clypeus in ventral oblique view; d – apical flagellomeres of female; e – female tergum I in lateral view (arrow indicates expanded basolateral carina).

Dorsal length of flagellomeres I and II 1.4 × apical width; greatest length of flagellomere IX equal to 0.7 of apical width, of flagellomere X 1.7 × basal width (Fig. 128d). Forebasitarsus with eight rake spines. Setae of pygidial plate concealing integument near apex. Length 10.5 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 127).— Known from a single locality in the northern part of Northern Territory.

Records.— Holotype: ♀, **AUSTRALIA: Northern Territory** 16 km NE Mount Cahill at 12°50′S 132°51′E [in Kakadu National Park], 16 Nov 1972, J.C. Cardale (ANIC).

***Sericophorus nasutus* Pulawski, sp. nov.**
Figures 127, 129.

Name derivation.— *Nasutus*, Latin masculine adjective meaning *with big nose*.

Recognition.— The female of *nasutus* (the male is unknown) is characterized by the appressed body setae, the black head, thorax, propodeum, and gaster (except for the pale yellow mesoventral portion of the clypeus and basal portion of the mandible), and contrastingly reddish brown femora, tibiae, and tarsi. It can be recognized by a unique combination of the basolateral carina of tergum I that extends beyond the anterior margin of the spiracle, presence of an elevation on the clypeal middle lobe (elevation top vertical), and presence of a spiny process on sternum I. Subsidiary recognition features are: ocellocular distance equal to 1.4 × hindocellar width, apical depression of tergum II impunctate, and setae of frons and clypeus golden.

Description (based on holotype only).— Head broad (Fig. 129a), width 1.3 × height (measured from clypeus ventral margin to top of vertex). Frontal punctures minute, less than one diameter apart. Frontal line not extending into frons dorsal half. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.4 × hindocellar width. Middle clypeal section elevated, tip of elevation vertically extended; free margin of clypeal lamella emarginate mesally (Fig. 129b, c). Propleuron prominent posterolaterally. Scutal punctures less than one diameter apart, about one diameter apart near center; scutal flange ending abruptly. Mesopleural punctures less than one diameter apart. Propodeal dorsum with ridges that are longitudinal and conspicuous basally, becoming gradually oblique and evanescent, interspaces punctate, with shallow, glabrous sulcus containing median carina and oblique carinae that emerge from it; side minutely ridged; posterior surface

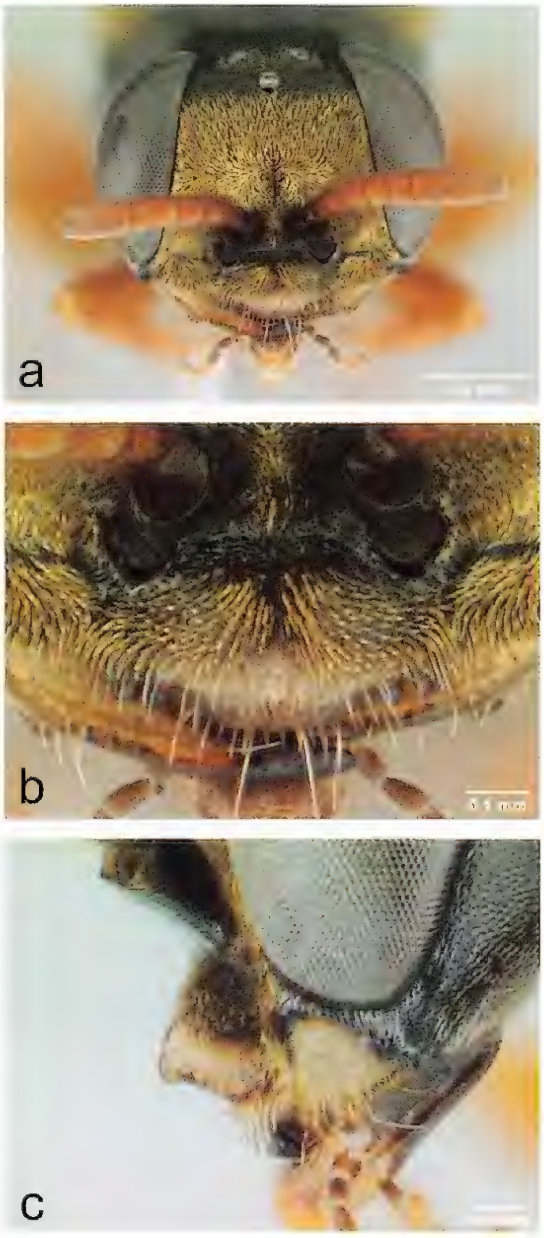

Figure 129. *Sericophorus nasutus* Pulawski sp. nov.: a – female head in frontal view; b – female clypeus in frontal view; c – female clypeus in lateral view.

punctate except for median sulcus, dorsomedian area minutely ridged. Forewing vein M interstitial with cu-a; second submarginal narrowly opened anteriorly. Tergum I concave basally, basolateral carina inconspicuous, ending behind anterior margin of spiracle; punctures of horizontal area 3–4 diameters apart posteriorly; apical depression with evanescent, sparse punctures; apical depression of tergum II impunctate. Sternum I: see below.

Setae of lower frons and clypeus golden, fully obscuring integument; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black (including scape and pronotal lobe) except clypeal lobe pale yellow ventrally, mandible pale yellow ventrally and dark brown apically, and flagellum reddish brown. Forecoxal venter pale yellow, black anteriorly; femora, tibiae, and tarsi reddish brown.

♀.— Orbital fovea well defined, more than half width of ocellocular distance. Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.8 × apical width; greatest length of flagellomere X 1.3 × basal width. Forebasitarsus with five rake spines. Setae of pygidial plate concealing integument apically. Sternum I with basal ridge expanded into spiny process (as in Fig. 138), area between process and apical margin concave Length 6.4 mm.

♂.— Unknown.

Geographic distribution (Fig. 127).— Known from one locality in New South Wales.

Records.— Holotype: ♀, **AUSTRALIA: New South Wales**: Shoalhaven River via Braidwood, 2 Jan 1987, I.D. Naumann (ANIC).

Sericophorus niger (Hacker and Cockerell)

Figures 130–132.

Zoyphium nigrum Hacker and Cockerell, 1922:286, ♀, ♂. Lectotype: ♂, Australia: Queensland: Brisbane (QMB), **present designation by O. Lomholdt**, examined by O. Lomholdt and W. Pulawski.— As *Sericophorus niger*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:253 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus niger* shares with *emarginatus* and *lissonotus* the conspicuously emarginate mesally pronotal collar. See *emarginatus* for differences (p. 76). See also Status of the Species under *emarginatus*.

Description.— Inner orbits nearly parallel. Frontal punctures minute, nearly compressed against each other; frontal line either ill defined or well defined. Ocellocular distance equal to 1.0–1.1 × hindocellar width. Interocellar area convex adjacent to hindocellus, concave mesally. Pronotal collar conspicuously emarginate mesally, and also broadly emarginate posterolaterally. Scutal punctures less than one diameter apart; interspaces nearly unsculptured; scutal flange gradually narrowing toward apex. Mesopleural punctures about one diameter apart near center; interspaces nearly unsculptured. Propodeal dorsum obliquely ridged (ridges conspicuous near base and evanescent posteriorly in female, all conspicuous in male), punctate between ridges, with median impression and conspicuous median carina inside impression, with one longitudinal ridge and a few evanescent ridges just behind spiracle; side practically unsculptured except for minute, sparse punctures and except ridged dorsally and punctate posteriorly; posterior surface punctate and with evanescent ridges (except for median sulcus). Forewing vein M diverges from M+Cu basad of cu-a; second submarginal cell triangular. Punctures of tergum I minute, about one diameter apart; apical depressions of terga I and II punctate throughout except along hindmargin.

Setae silvery, obscuring integument on lower frons and clypeus; appressed on upper frons,

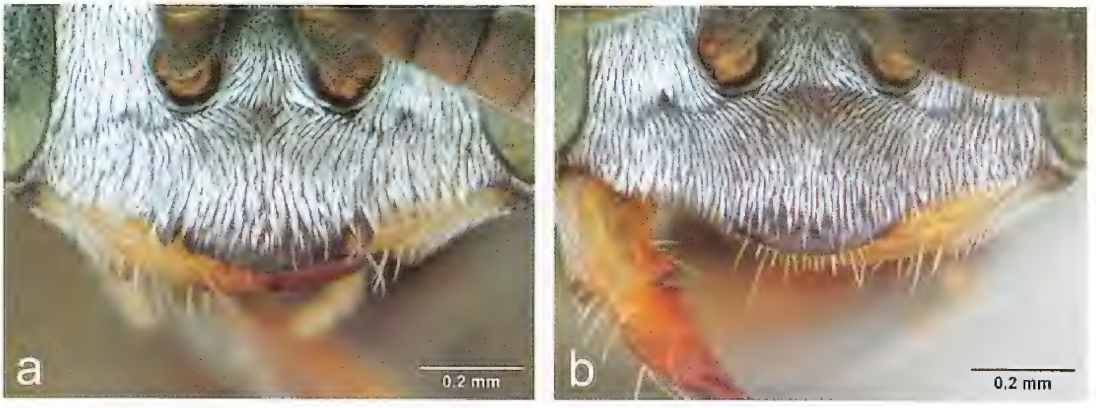

FIGURE 130. *Sericophorus niger* (Hacker and Cockerell): a – female clypeus in frontal view; b –male clypeus in frontal view.

postocellar area, and scutum; inclined anterad on propodeal dorsum (median impression glabrous).

Head (including antenna), thorax, propodeum, and gaster black except mandible pale yellow basally (dark brown apically) and male pronotal lobe pale yellow. Legs black, tarsi pale yellow or tarsomeres I and V brown.

♀.— Orbital fovea absent. Clypeal lamella arcuate, inner lateral tooth ill defined, outer lateral tooth well defined (Fig. 130a). Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX equal to 0.8 × apical width, of flagello-mere X 1.4 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate not obscuring integument. Length 6.0 mm.

♂.— Clypeal lamella markedly arcuate, without lateral teeth (Fig. 130b). Dorsal length of flagellomere I about 1.0 × apical width, of flagellomere II 0.7 × apical width; greatest length of flagellomere IX equal to 0.5 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with four or five rake spines. Sternum VIII rounded apically except minimally emarginate (Fig. 131a). Genitalia: Fig. 131b. Length 5.0–5.5 mm.

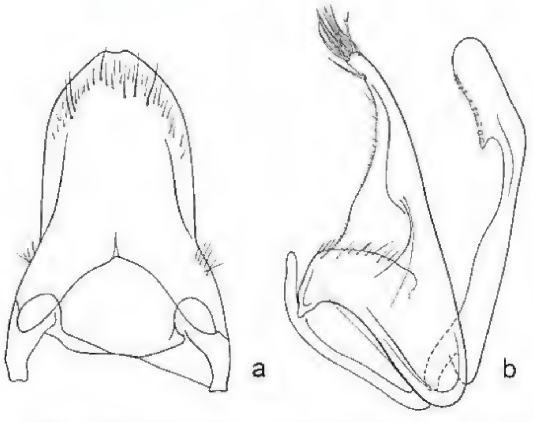

FIGURE 131. *Sericophorus niger* (Hacker and Cockerell): a – sternum VIII of male; b – male genitalia in lateral view.

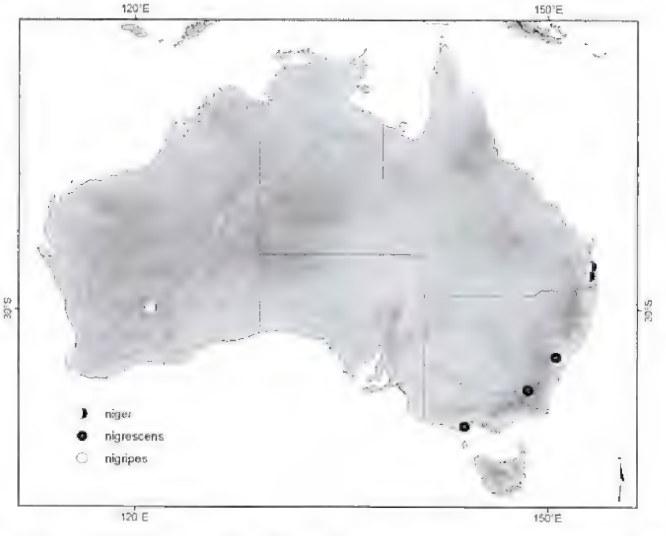

FIGURE 132. Collecting localities of *Sericophorus niger*, *nigrescens*, and *nigripes*.

GEOGRAPHIC DISTRIBUTION (Fig. 132).— Known from three localities in southeastern Queensland.

RECORDS.— AUSTRALIA: Queensland: Beerhwah, 29 Sept 1998 (1 ♀, ANIC); Brisbane, 13 Oct 1914 (1 ♂, QMB, lectotype of *Zoyphium nigrum*), 25 Sept 1919 (1 ♂, BMNH, paralectotype of *Zoyphium nigrum*); Caloundra, 28 Sept 1913 (1 ♀, QMB), 20 Sept 1964 (1 ♂, UQIC).

***Sericophorus nigrescens* Lomholdt, sp. nov.**

Figures 132–134.

NAME DERIVATION.— *Nigrescens*, Latin for *blackish*.

RECOGNITION.— *Sericophorus nigrescens* is one of several species in which the upper frons and postocellar area are covered with erect setae, the anterior declivity of tergum I is concave, the frons, thorax, propodeum, and gaster are black (gastral apex reddish brown), the ocellocular distance is equal to 0.8 × hindocellar width. *Sericophorus sanguineus* and *triangularis* are similar, but *nigrescens* differs in having the following: the horizontal area of tergum I with a low, median swelling anteriorly and the propodeal side separated from the posterior surface by a series of oblique ridges that are not crossed by longitudinal ridge (zigzagging, longitudinal ridge present in the other two). Also, lateral clypeal tooth is nonprominent (Fig. 133a) while prominent in *triangularis*, the pronotal collar attains the level of scutum (not attaining in *triangularis*), the glabrous, median sulcus of the propodeal dorsum is parallel-sided (widening anterad in *triangularis*), and the foretarsus is reddish brown (foretarsomeres I-IV dark brown in *triangularis*).

DESCRIPTION.— Frons somewhat swollen mesally; frontal punctures about one diameter apart, with small impunctate area near center; frontal line ending at about frons midheight. Ocellocular distance equal to 0.8 × hindocellar width. Most scutal punctures about one diameter apart, but many punctures up to two or three diameters apart admedially near center; scutal flange gradually narrowing toward apex. Mesopleural punctures averaging about three diameters apart at center, but many nearly contiguous. Scutellum behind midlength slightly, obtusely conical, shiny, with evanescent microsculpture (contrasting with adjacent areas). Propodeal dorsum punctate, in some specimens with minute, longitudinal ridges between punctures, with series of short ridges radiating from propodeal foremargin, with glabrous, median, well defined sulcus that contains several transverse carinae and in some specimens also median carina; side minutely, mostly longitudinally rugose, separated from posterior surface by series of conspicuous, oblique ridges (but no longitudinal ridge); posterior surface mostly or all ridged (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell markedly narrowed anteriorly or triangular. Horizon-

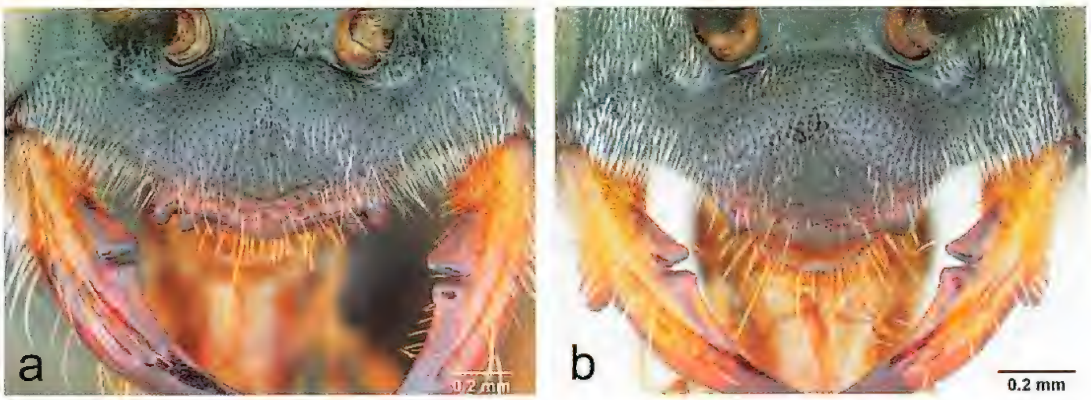

FIGURE 133. *Sericophorus nigrescens* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view.

tal area of tergum I with well defined punctures that are several diameters apart (interspaces practically unsculptured); anteriorly with obtuse, median swelling (which is ill defined in male); anterior declivity markedly concave; apical depressions of terga I and II unsculptured and shiny in apical third or so.

Setae not obscuring integument on frons or clypeus; erect on upper frons and postocellar area; on interocellar area about 0.5–0.6 × as long as midocellar width, on scutum erect, about 0.4 × as long as midocellar width; erect on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following: clypeal lamella dark brown; mandible yellow basally, dark brown apically; female flagellum bright reddish brown (male flagellum dark brown, slightly reddish ventrally); pronotal collar slightly reddish brown; female pygidial plate and apex of male tergum VII reddish brown. Femora mainly black or dark brown; tibiae and tarsi bright reddish brown.

♀.— Orbital fovea ill defined. Free margin of clypeal lobe arcuate (Fig. 133a). Dorsal length of flagellomeres I and II about 1.3 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X about 1.3 × basal width. Forebasitarsus with 5–7 rake spines. Setae of pygidial plate concealing integument. Length 9.0–10.0 mm.

♂.— Free margin of clypeal lobe arcuate (Fig. 133b). Dorsal length of flagellomeres I and II about 1.0 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X about 1.4 × basal width. Forebasitarsus with 4–6 rake spines. Length 6.0–8.0 mm. Sternum VIII shallowly emarginate apically (Fig. 134a). Genitalia: Fig.134b.

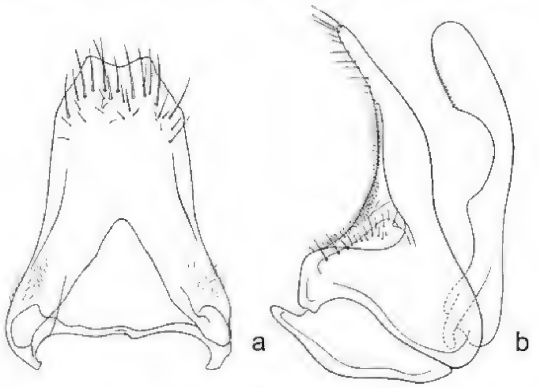

FIGURE 134. *Sericophorus nigrescens* Lomholdt, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 132).— New South Wales and Victoria.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **New South Wales**: Kiandra, 10 Feb 1961, E.F. Riek (ANIC). PARATYPES: **AUSTRALIA**: **New South Wales**: 6 km NE Bilpin near Kurrajong, 26 Nov 1978, N.W. Rodd (1 ♀, AMS); Kosciuszko State Park: Ogilvies Creek near Round Mountain, 28 Dec 1977, E.I. Schlinger (1 ♂, CAS). **Victoria**: Lorne, 23 Dec 1968, on *Eucalyptus* sp., E.M. Exley (1 ♀, 2 ♂, UQIC).

Sericophorus nigripes Lomholdt, sp. nov.

Figures 132, 135, 136.

RECOGNITION.— *Sericophorus nigripes* has erect setae on the upper frons and postocellar area, a concave anterior declivity of tergum I, and the propodeal side separated from the posterior surface by a series of oblique ridges (but no longitudinal ridge). Additionally, the postocellar area is dark metallic blue (only faintly so in the male), the scutellum is evenly convex (not compressed into a carina), the propodeal dorsum is punctate on each side of the median sulcus, and the mid- and hindfemora are black. As in *cliffordi*, the ocellocular distance is about 1.6 × midocellar width, but unlike that species the clypeal lamella is straight (rather than slightly arcuate), with the outer tooth prominent (rather than nonprominent). The species is strikingly similar to *littoralis*, with which it occurs sympatrically. It differs from the latter mainly in having the head dark metallic blue (only partly so in the male) rather than all black, black mid- and hindlegs (rather than reddish brown), and a strikingly different penis valve (compare Figs. 136b and 109b). Also, the median sul-

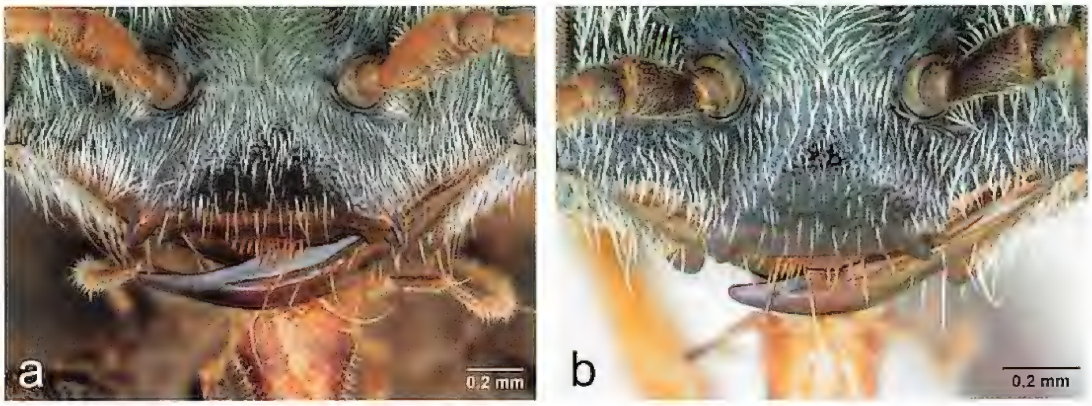

FIGURE 135. *Sericophorus nigripes* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view.

cus of the propodeal dorsum is slightly wider in *nigripes*, and the female clypeus is flattened ventrally rather than concave.

DESCRIPTION.— Head transverse in frontal view, its maximum width about 1.33 × maximum height in both sexes (measured from clypeus ventral margin to top of vertex). Frons swollen mesally, with shallow, ill defined punctures, most punctures averaging about one diameter apart; frontal line ill defined except near frons center where it forms short carina; interocellar area convex adjacent to hindocellus, concave mesally. Antennal socket separated from clypeal free margin by less than two socket widths. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.6 × midocellar width in female, 1.8 × in male. Scutal punctures about 2–3 diameters apart near center; scutal flange gradually narrowing toward apex. Mesopleural punctures about 1–4 diameters apart near center. Propodeal dorsum adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, glabrous, longitudinal sulcus; longitudinal sulcus containing median carina (except apically) and a few transverse carinae; remaining surface punctate; side ridged, separated from posterior surface by series of conspicuous oblique ridges (but no longitudinal ridge); posterior surface punctate dorsally, ridged ventrally (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell markedly narrowed anteriorly. Horizontal area of tergum I with nearly contiguous punctures; anterior declivity concave; apical depressions of terga I and II punctate throughout.

Setae silvery, largely concealing integument on ventral half of frons laterally and on lateral clypeal section; erect on upper frons and postocellar area; about as long as 1.0 × midocellar width on interocellar area and 0.3 × midocellar width on scutum; inclined anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster dark metallic green with following exceptions: in male lower frons nearly black and clypeus black; antenna brown (apical flagellomere nearly all black in female, in male flagellum nearly black dorsally); mandible brown, black apically. Femora black with faint greenish luster (male mid-and hindfemora without luster), female forefemur reddish brown in apical half or so; foretibia and foretarsus reddish brown, mid- and hindtibiae and tarsi black (apical tarsomeres reddish brown).

♀.— Orbital fovea absent. Lateral tooth of clypeal lamella prominent. Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.0–1.1 × basal width. Forebasitarsus with seven or eight rake spines. Setae of pygidial plate not concealing integument except apically. Length 8.2–9.3 mm.

♂.— Clypeal lamella with one tooth on each side, tooth prominent. Dorsal length of flagello-

meres I and II 1.0 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.1 × basal width; flagellomeres IV and V slightly expanded apicoventrally. Forebasitarsus with five rake spines. Segment VIII emarginate apically (Fig. 136a). Genitalia: Fig. 136b. Length 6.0 mm.

Geographic distribution (Fig. 132).— Known from one locality in Western Australia.

Records.— Holotype: ♀, **AUSTRALIA: Western Australia**: Goongarrie at 29°55′S 121°08′E, Oct 1980, W.F. Humphreys (WAMP). Paratypes: **AUSTRALIA: Western Australia**: Goongarrie at 29°55′20″S 121°07′55″E, Oct 1980, W.F. Humphreys (1 ♀, CAS); same data as holotype (1 ♂, WAMP).

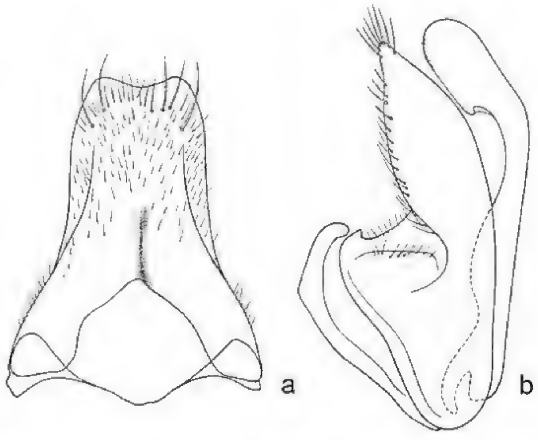

Figure 136. *Sericophorus nigripes* Lomholdt, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view.

Sericophorus nigror Rayment

Figures 136–140.

Sericophorus nigror Rayment, 1955a:37, ♀. Holotype: ♀, South Australia: Lucindale (SAM), examined by O. Lomholdt and W. Pulawski.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:248 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus nigror* is characterized by the following combination: frons with a conspicuous median swelling (Fig. 137e), posterior pronotal margin slightly depressed mesally, thorax, propodeum and gaster black except pronotal collar laterally and pronotal lobe which are pale yellow. Also, the middle clypeal section is elevated (inconspicuously so in the male), with a concave, glabrous area between the elevation top and free margin and a longitudinal carina between the frontoclypeal suture and the elevation top (Fig. 137c, d). In the female, the basal ridge of sternum I is expanded into a spiny process, and the area between the process and apical margin is deeply concave (Fig. 138).

Description.— Inner orbits parallel in male. Frons deeply impressed above antennal socket, with conspicuous median swelling (Fig. 137e) that is bisected by frontal line; frontal punctures almost contiguous. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.2 × hindocellar width. Posterior mandibular margin slightly convex between base and notch. Pronotal collar slightly depressed mesally. Propleuron expanded posterolaterally (expansion oriented anterad). Punctures of scutum and mesopleuron less than one diameter apart, interspaces unsculptured, shiny; scutal flange widest apically, ending abruptly. Propodeal dorsum with conspicuous ridges near foremargin, glabrous anteriorly, remainder inconspicuously ridged and punctate; glabrous median impression well defined only posteriorly, widening posterad, transversely ridged; median carina ill defined (well defined anteriorly in some specimens); side with well-defined ridges dorsally, ridges gradually finer toward venter; posterior surface closely punctate (except for median sulcus), with ridges at least ventrally. Forewing vein M interstitial with cu-a or diverging from M+Cu basad of cu-a; second submarginal cell narrowly open anteriorly. Terga closely punctate; tergum I with punctures that are about one diameter apart; apical depressions of terga I and II punctate except narrowly unsculptured next to apical margin. Sternum I: see below.

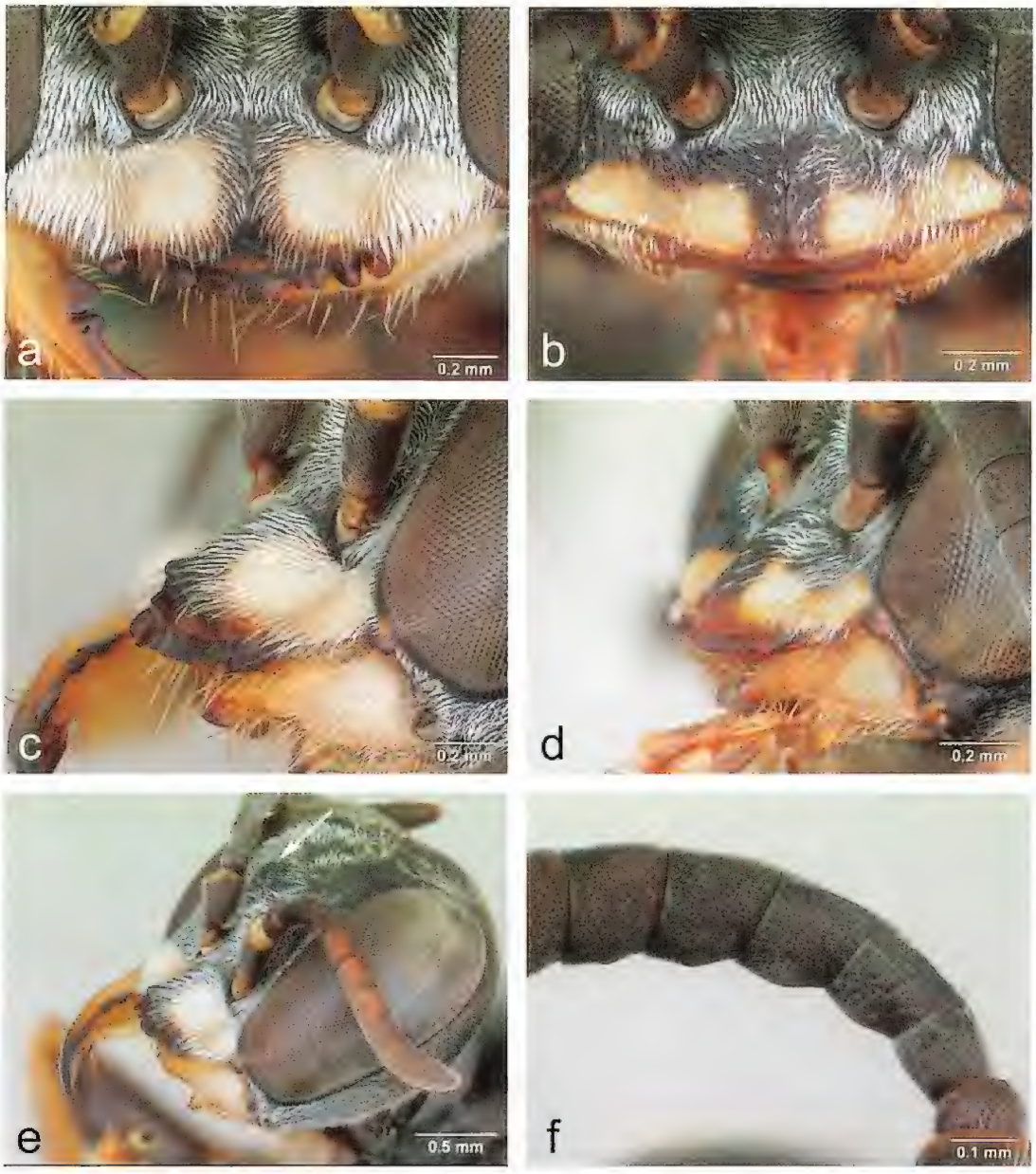

FIGURE 137. *Sericophorus nigror* Rayment: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female clypeus in lateral oblique view; d – male clypeus in lateral oblique view; e – female head in lateral oblique view (arrow indicates frontal swelling); f – basal flagellomeres of male.

Setae on lower frons and clypeus silvery, nearly completely concealing integument; appressed on upper frons, postocellar area, and scutum; on propodeal dorsum appressed, oriented anterad (dorsum asetose along midline).

Head, thorax, propodeum, and gaster black except the following: mandible pale yellow basally, black apically; antenna all back or flagellum brownish ventrally; clypeus pale yellow, with median black strip, black basally in male; lateroclypeal suture black in one male; pronotal collar

pale yellow except black mesally; pronotal lobe pale yellow apically. Legs black, foretibial inner surface reddish brown; tibiae each with pale yellow longitudinal spot dorsally; forecoxal venter pale yellow.

♀.— Orbital fovea elongate, narrower than half ocellocular distance. Middle clypeal section with roof-like elevation, concave and glabrous between elevation top and free margin; with median carina between frontoclypeal suture and elevation top, free margin of elevation either emarginate or projecting mesally (Fig. 137a, c). Dorsal length of flagellomere I 1.2 × apical width, of flagellomere II 1.3 × apical width; greatest length of flagellomere IX 1.0 × apical width, of flagellomere X 1.7 × basal width. Forebasitarsus with six or seven rake spines. Sternum I with basal ridge expanded into spiny process, area between process and apical margin deeply concave (Fig. 138). Length 8.5–10.0 mm.

♂.— Middle clypeal section slightly elevated, with short, perpendicular, glabrous area between main clypeal surface and anterior portion (Fig. 137b, d). Flagellomeres I-III with convex, brown tyloids (Fig. 137f). Dorsal length of flagellomeres I and II 1.1 × apical width, greatest length of flagellomere IX 1.00 × apical width, of flagellomere X 1.5 × basal width. Forebasitarsus with four or five rake spines. Sternum I with short median ridge basally. Sternum VIII: Fig. 139a. Genitalia: Fig. 139b. Length 6.0–7.0 mm.

FIGURE 138. *Sericophorus nigror* Rayment: base of female gaster in ventral oblique view (arrow indicates spiny process of sternum I).

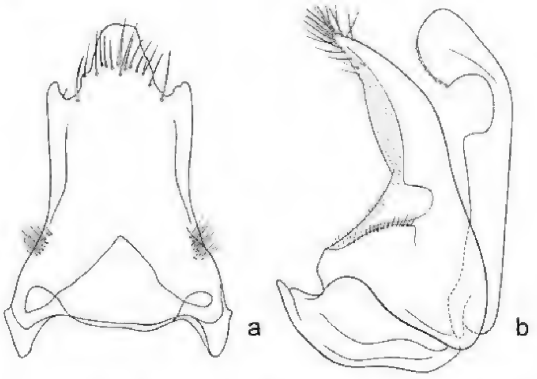

FIGURE 139. *Sericophorus nigror* Rayment: a – sternum VIII of male; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 140).— South Australia.

RECORDS.— AUSTRALIA: South Australia: Coorong National Park: 2 miles NW of Wood's Well, 13 and 14 Jan 1971 (1 ♀, CAS; 1 ♀, 1 ♂, SAM); Hindmarsh Valley near Adelaide, 8 Jan 1966 (1 ♂, BMNH, paratype of *nigror*); Lucindale, 28 Feb 1911 (3 ♀, SAM, holotype and paratypes of *nigror*).

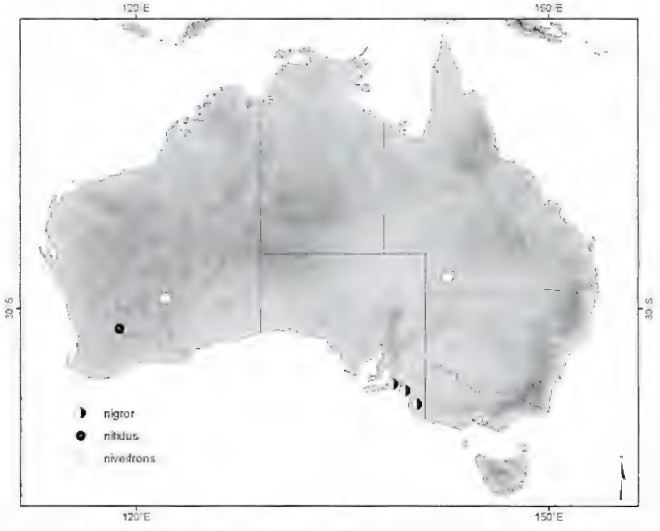

FIGURE 140. Collecting localities of *Sericophorus nigror*, *nitidus*, and *niveifrons*.

***Sericophorus nitidus* Pulawski, sp. nov.**
Figures 140, 141.

NAME DERIVATION.— *Nitidus*, Latin for shiny; with reference to the shiny, largely impunctate frons and scutum of this species.

RECOGNITION.— Like *politus*, the female of *nitidus* is characterized by a combination of a sparsely punctate frons (Fig. 141a, punctures several diameters apart except lateroventrally), scutal disk (Fig. 141c, punctures many diameters apart), and female pygidial plate (Fig. 141d, interspaces averaging markedly larger than punctures), and a long foretarsal rake (apical spine of foretarsomere III longer than foretarsomere IV). The male is unknown. Unlike *politus*, the occipital carina joins the hypostomal carina (rather than not joining), the axilla is not significantly expanded (its outer margin is straight or nearly so) rather than expanded (with the outer margin markedly convex), the setae are markedly finer above the scrobal sulcus than beneath it (rather than uniform), and all terga are black (rather than terga II-V with broadly interrupted, apical, whitish fasciae).

DESCRIPTION (based on holotype only).— Inner orbits almost parallel (Fig. 141a). Frontal punctures fine, many diameters apart except about one diameter apart lateroventrally (Fig. 141a); interspaces unsculptured, shiny. Frontal line ending slightly above frontal midheight. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.2 × hindocellar width. Middle clypeal section with a few, sparse punctures except densely punctate basally; lamella slightly arcuate. Pronotal collar not reaching level of scutum. Scutal punctures (except anteriorly) many diameters apart (Fig. 141c); scutal flange gradually narrowing

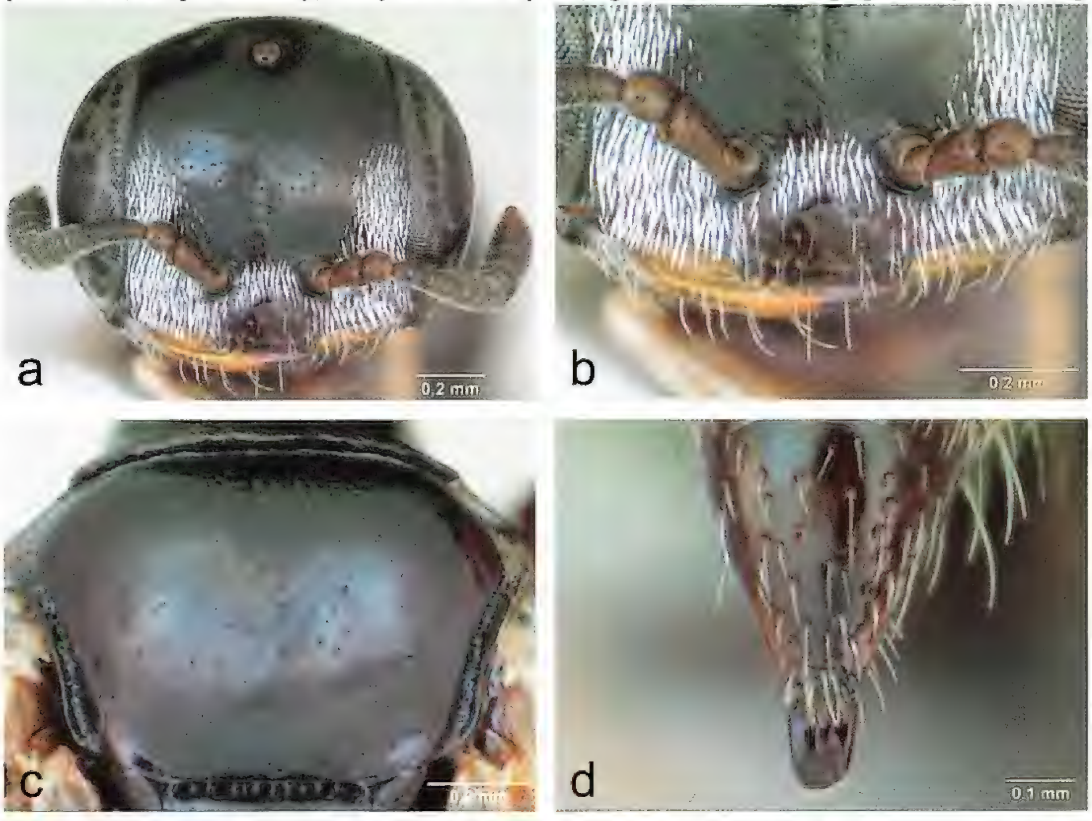

FIGURE 141. *Sericophorus nitidus* Pulawski, sp. nov.: a – female head in frontal view; b – female clypeus in frontal view; c – female scutum in dorsal view; d – pygidial plate of female in dorsal view.

toward apex. Mesopleural punctures averaging about two diameters apart near center. Mesothoracic venter with punctures averaging many diameters apart. Propodeal dorsum rugose except for transversely carinate glabrous median sulcus (sulcus also with longitudinal carina); side rugose, ridged ventrally; posterior surface rugose (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell open anteriorly. Forecoxal venter unsculptured, shiny. Foretarsal rake long, apical rake of foretarsomere III longer than foretarsomere IV. Tergum I concave basally, punctures of its horizontal area averaging about 2–3 diameters part; apical depression punctate; apical depression of tergum II punctate. Sternum I with bifurcating median ridge in basal half.

Setae of lateroventral portion of frons and lateral clypeal section silvery, almost completely obscuring integument; practically absent on upper frons and scutum, appressed on postocellar area; appressed, oriented anterad on propodeal dorsum; largely obscuring integument below mesopleural scrobe, but not on episcrobal area.

Head (including antenna), thorax, propodeum, and gaster black except flagellomere X brown apically, mandible yellowish mesally, reddish brown apically, and pronotal lobe brown posteriorly. Femora black; tibiae pale yellow, yellowish brown ventrally; tarsi pale yellow.

♀.— Orbital fovea absent. Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II about 1.0 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.1 × basal width. Apical rake spines of forebasitarsus missing, but apical rake spine of foretarsomere III markedly longer than foretarsomere IV. Punctures of pygidial plate several diameters part (Fig. 141d). Length 2.6 mm.

♂.— Unknown.

Geographic distribution (Fig. 140).— Known from one locality in Western Australia.

Records.— Holotype: ♀, **AUSTRALIA: Western Australia**: 30 mi. E Merredin, 16 Sept 1962, E.S. Ross and D.Q. Cavagnaro (CAS).

Sericophorus niveifrons Rayment

Figures 140, 142, 143.

Sericophorus niveifrons Rayment, 1955a:38, ♀. Holotype: ♀, Australia: Queensland: 5 mi. N Nocatunga (ANIC), examined by O. Lomholdt and W. Pulawski.— Bohart and Menke, 1976:302 (listed); Cardale, 1985:248 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus niveifrons* is characterized by the presence of erect setae on the upper frons and postocellar area, a concave anterior declivity of tergum I, metallic green thorax, propodeum, and terga and a contrastingly black head, and the propodeal side separated from the posterior surface by a series of oblique ridges. It differs from similar species in having the scutum and mesopleuron unsculptured, shiny between punctures (rather than conspicuously microsculptured, dull). As in *viridis*, male flagellomeres II-VI are conspicuously prominent ventrally (Fig. 142c). Unlike *viridis*, the setae of *niveifrons* on the interocellar area are about as long as 0.6 of midocellar width, and those on the scutum about as long as 0.3 × midocellar width (rather than about 1.0–1.2 × and 0.7–1.0 × midocellar width, respectively), and the costal vein is yellowish brown.

Description.— Frons swollen near center; frontal punctures averaging about one diameter apart, markedly more near top of swelling; interspaces unsculptured except microareolate near midocellus; frontal line reaching midocellus; interocellar area convex adjacent to hindocellus, concave mesally. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.2 × hindocellar width. Scutal punctures well defined, averaging

more than one diameter apart near center, interspaces unsculptured, shiny; scutal flange widest preapically, gradually narrowing toward apex. Mesopleural punctures well defined, averaging more than one diameter apart beneath scrobe; interspaces unsculptured, shiny. Propodeal dorsum adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, well-defined, glabrous, longitudinal sulcus (longitudinal sulcus contains transverse carina at about midlength); remaining dorsum finely punctate (punctures more than one diameter apart adjacent to sulcus); side minutely punctate except unsculptured anteriorly, delimited from posterior surface by oblique ridges that are crossed by longitudinal, zigzagging ridge; posterior surface punctate (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly. Punctures about two diameters apart on terga I and II, slightly more on terga III and IV; interspaces shiny; anterior declivity of tergum I markedly concave, apical depression punctate.

Setae silvery on lower frons and clypeus, not concealing integument; erect on upper frons and postocellar area, on interocellar area about 0.6 × as long as midocellar width; about as long as 0.5 of midocellar width on postocellar area and lower gena; on scutum light, suberect, about as long as 0.3 of midocellar width; suberect on propodeal dorsum.

Head black except the following: middle clypeal section reddish brown in female (black along dorsal margin); mandible yellowish red, apex brown; antenna reddish brown in female, largely dark in male. Thorax and propodeum greenish or bluish green, pronotal lobe reddish in female. Femora, tibiae, and tarsi reddish brown, forefemur black basally in male. Gaster shiny, bluish or bluish green. Female pygidial plate dark reddish brown.

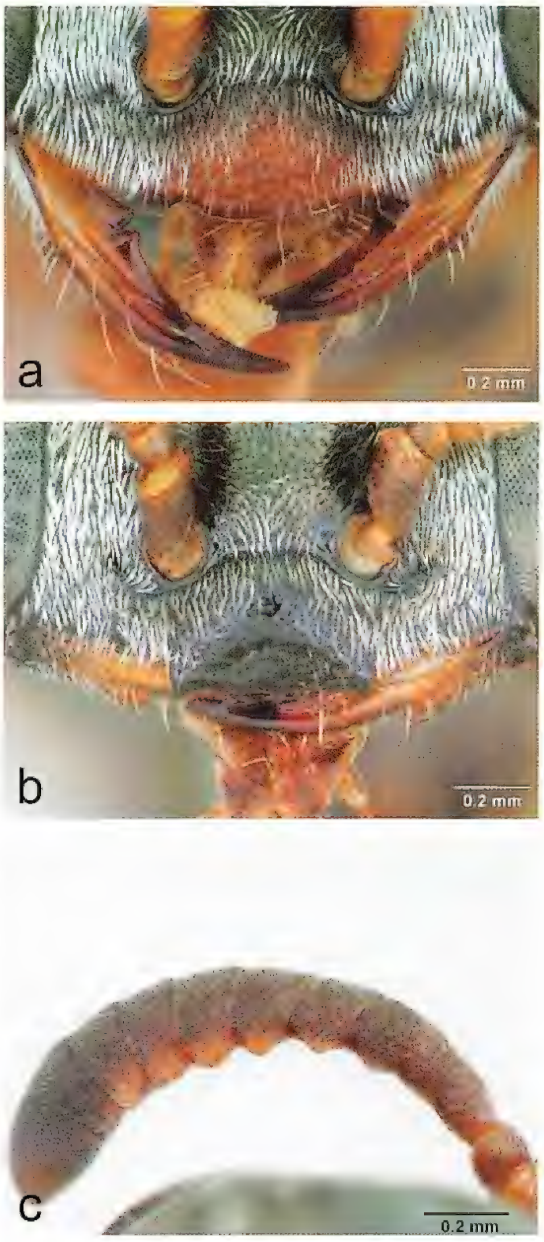

FIGURE 142. *Sericophorus niveifrons* Rayment: a – female clypeus in frontal view; b – male clypeus in frontal view; c – male antenna in frontal view.

♀.— Clypeal lamella minimally arcuate (Fig. 142a). Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with six or seven rake spines. Setae of pygidial plate not concealing integument. Length 6.0–6.5 mm.

♂.— Middle clypeal section markedly protruding, concave in ventral half or so, lamella trun-

cate, with sharply angulate corner (Fig. 142b). Flagellomeres II-VI prominent ventrally (Fig. 142c). Dorsal length of flagellomere I 0.9 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with five rake spines. Sternum VIII truncate apically (Fig. 143a). Genitalia: Fig. 143b. Length 5.5 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 140).— Queensland and Western Australia.

RECORDS.— **AUSTRALIA**: **Queensland**: 5 mi. N Nocatunga, 13 Nov 1949 (1 ♀, ANIC, holotype of *niveifrons*); near Noccundra, 13 Nov 1949 (1 ♂, ANIC). **Western Australia**: Yundamindra Homestead at 29°15′S 122°06′E, 16 Mar 1979 (1 ♀, WAMP).

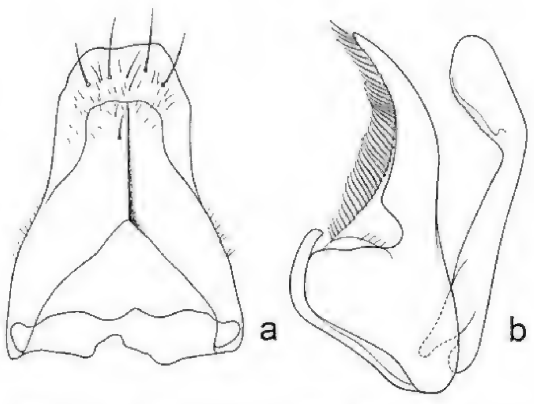

FIGURE 143. *Sericophorus niveifrons* Rayment: a – sternum VIII of male; b – male genitalia in lateral view.

Sericophorus ornatus (Hacker and Cockerell)

Figures 144–146.

Zoyphium ornatum Hacker and Cockerell, 1922:287, ♀, ♂. Lectotype: ♀, Australia: Queensland: Brisbane: Birkdale (QMB), **present designation by O. Lomholdt**, examined by O. Lomholdt and W. Pulawski.— As *Sericophorus ornatus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:253 (in catalog of Australian Sphecidae).

RECOGNITION.— *Sericophorus ornatus* has the setae appressed on the upper frons and postocellar area, and it lacks morphological specializations (clypeal free margin and pronotal collar not emarginate mesally, horizontal portion of axilla not expanded, forewing with three submarginal cells, basolateral carina of tergum I short, inconspicuous, ending well before anterior margin of spiracle, sternum I simple). Furthermore, the frons, thorax, and propodeum are black, without metallic luster or yellow markings (pronotal lobe dark reddish). It differs from similar species by its coloration: the clypeus is yellow (all in female, partly so in male), the forecoxa is partly yellow, and the gaster is largely reddish brown. Additionally, the femora are reddish brown with yellow markings, and the setae totally obscure the integument on the lower frons laterally.

DESCRIPTION.— Inner orbits almost parallel in male. Frons slightly impressed above antennal socket; frontal punctures minute, averaging about one diameter apart; frontal line not extending above frontal midheight. Ocellocular distance equal to 0.7–0.8 × hindocellar width. Clypeal lamella sinuate (Fig. 144a, b). Scutal punctures nearly contiguous; scutal flange ending abruptly. Mesopleural punctures more than one diameter apart near center, interspaces alutaceous, unsculptured posteriorly. Propodeal dorsum punctate, with oblique ridges that are conspicuous basally and evanescent on remaining surface, mesally with glabrous impression and longitudinal carina; side punctate and finely ridged, unsculptured anteriorly; posterior surface punctate except for median sulcus, unsculptured, shiny mesodorsally. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular. Preapical portions of terga I and II mesally with punctures that are several to many diameters apart, apical depression of tergum I impunctate posteriorly; apical depression of tergum II impunctate.

Setae silvery on frons, concealing integument on lower frons laterally but not on clypeus;

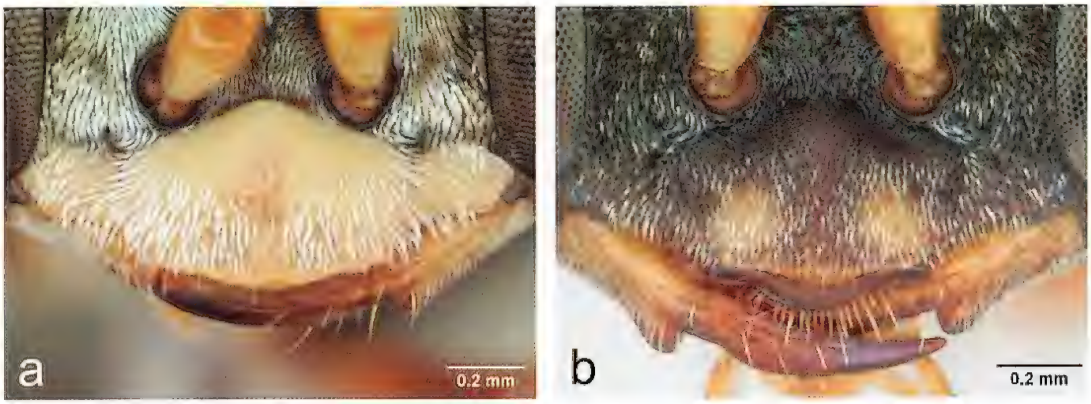

FIGURE 144. *Sericophorus ornatus* (Hacker and Cockerell): a – female clypeus in frontal view; b – male clypeus in frontal view.

appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

Head, thorax, and propodeum black except the following: clypeus all yellow in female, reddish brown with pair of yellow spots in male; scape yellow, pedicel and flagellum reddish brown; pronotal collar narrowly dark reddish. Forecoxa pale yellow except anteriorly; femora reddish brown, forefemur with apex and most of venter yellow, midfemur yellow ventrally in apical half, hindfemur with small yellow spot apically on outer side; tibiae and tarsi reddish brown, foretibia yellow on outer side. Tergum I black except reddish brown posterolaterally, remaining terga reddish brown, with irregular dark spots.

♀.— Orbital fovea ill defined. Dorsal length of flagellomeres I and II 1.1 × apical width; greatest length of flagellomere IX 1.0 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with seven rake spines. Pygidial setae not concealing integument. Length 8.0–8.5 mm.

♂.— Flagellomeres II-IV slightly swollen ventrally. Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II

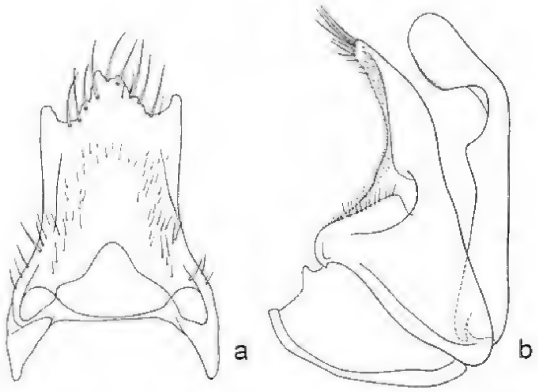

FIGURE 145. *Sericophorus ornatus* (Hacker and Cockerell): a – sternum VIII of male; b – male genitalia in lateral view.

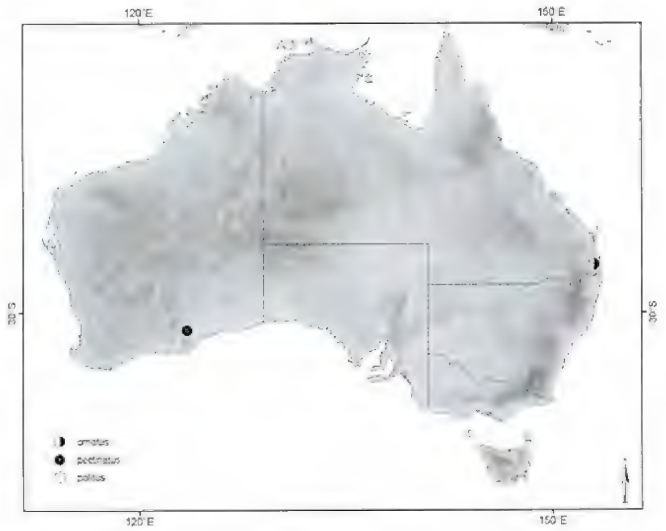

FIGURE 146. Collecting localities of *Sericophorus ornatus*, *pectinatus*, and *politus*.

0.9 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X 1.6 × basal width. Sternum VII: Fig.145a. Genitalia: Fig. 145b. Length 7.5 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 146).— Known only from Brisbane area, Queensland.

RECORDS.— **AUSTRALIA: Queensland**: Brisbane, 12 Feb 1918 (1 ♀, 1 ♂, QMB, lectotype and paralectotype of *Zoyphium ornatum*), 24 Nov 1917 (1 ♀, BMNH).

***Sericophorus papuanus* Pulawski, sp. nov.**
Figures 147, 148.

NAME DERIVATION.— *Papuanus*, a Neolatin adjective derived from Papua New Guinea, where the specimens were collected.

RECOGNITION.— *Sericophorus papuanus*, from Papua New Guinea, has a distinctive anterolateral area of tergum I: the spiracle extends anterad into a carina that reaches the basolateral tergal carina (Fig. 147c). Subsidiary recognition features are: head transverse in frontal view (Fig. 147a); setae appressed on the postocellar area; head, thorax, propodeum, and gaster black (except for the appendages); the middle clypeal section has no anteromedian elevation. Unlike another Papuan species, *subalaris*, the subalar area of the mesopleuron is not angularly expanded in *papuanus*.

DESCRIPTION.— Head transverse in frontal view, its maximum width 1.6 × maximum height (measured from clypeus ventral margin to top of vertex). Inner orbits markedly converging dorsad in ventral half (Fig. 147a). Frontal punctures minute, ill defined, less than one diameter apart. Frontal line ill defined but extending to midocellus. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.8 × hindocellar width. Free margin of clypeal lamella minimally convex, practically straight except concave adjacent to lateral teeth (Fig. 147b). Scutal punctures on disk averaging 1–2 diameters apart; scutal flange gradually narrowing toward apex. Mesopleural punctures minute, 2–3 diameters apart beneath scrobe; episternal sulcus barely areolate. Propodeal dorsum punctate (most punctures several diameters apart), with shallow median, glabrous depression that contains longitudinal carina; side unsculptured anteriorly, minutely punctate posteriorly; posterior surface punctate (except

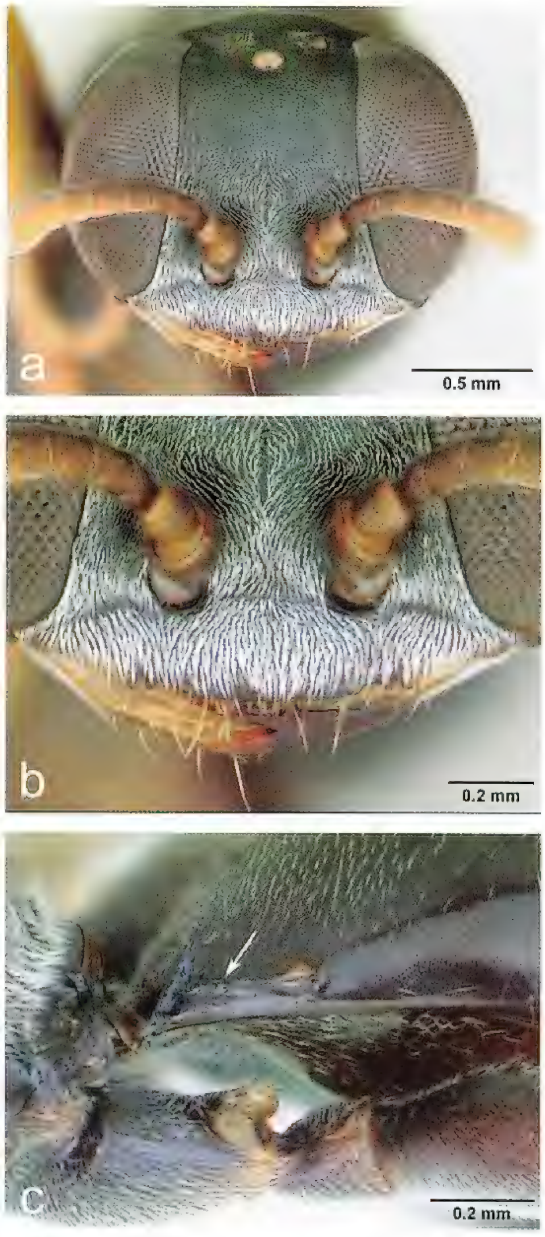

FIGURE 147. *Sericophorus papuanus* Pulawski, sp. nov.: a – female head in frontal view; b – female clypeus in frontal view; c – base of female gaster in lateral view (arrow indicates prespiracular carina of tergum I).

for median sulcus). Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular or nearly so. Tergum I: spiracle extending anterad as carina and reaching basolateral tergal carina (Fig. 147c); horizontal area with microscopically small punctures many diameters apart; apical depressions of terga I-V impunctate.

Setae of lower frons and clypeus silvery, not obscuring integument on frons, obscuring from most angles on clypeus; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except mandible yellow (dark brown apically), flagellum dark brown (yellowish brown ventrally), and tergum VI somewhat reddish. Femora black, yellowish apically (hindfemur only narrowly so), tibiae yellowish brown, tarsi yellow.

♀.— Orbital fovea absent. Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 1.1 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with five to seven rake spines. Setae of pygidial plate not concealing integument. Length 5.8–6.1 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 148).— New Guinea.

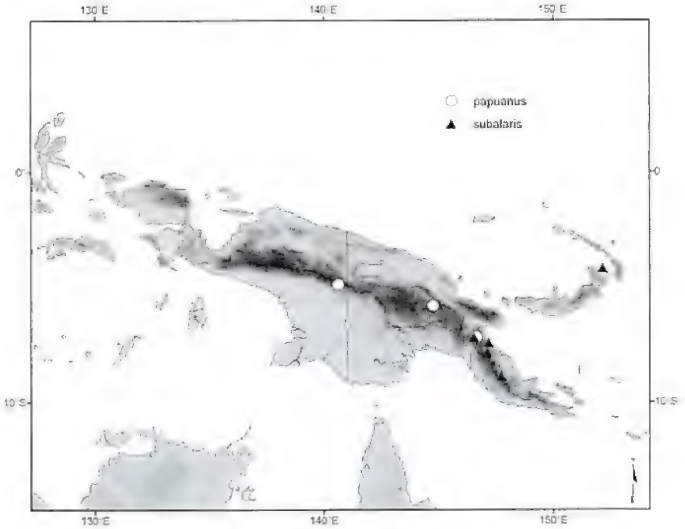

FIGURE 148. Collecting localities of *Sericophorus papuanus* and *subalaris*.

RECORDS.— HOLOTYPE: ♀, **PAPUA NEW GUINEA: Morobe Province**: Bulolo, 13 Feb–13 Mar 1979, J. Sedlaček (AEI). PARATYPES: **INDONESIA**: **Irian Jaya**: Sibil in Star Mts., 1200 m, at about 5°00′S 141°00′E, 9 May 1959, Netherlands New Guinea Expedition (1 ♀, RMNH). **PAPUA NEW GUINEA**: **Western Highland Province**: Jimmi Valley, 7 Feb–2 Mar 1979, J. Sedlaček (1 ♀, CAS).

Sericophorus pectinatus Lomholdt, sp. nov.

Figures 146, 149–151.

NAME DERIVATION.— A Latin adjective derived from *pecten*, a comb; with reference to the unusually long foretarsal rake.

RECOGNITION.— *Sericophorus pectinatus* is a small species (ranging from 3.5 to 4.0 mm), with the setae appressed on the postocellar area and scutum. As in *arrernte*, *axillaris*, and *politus*, the horizontal part of the axilla is expanded, its lateral margin convex, overhanging the depressed part (Fig. 150b), and the female pygidial plate is sparsely punctate basally and mesally (puncture at least two diameters apart). Unlike those three species, the propodeal dorsum of *pectinatus* is conspicuously, finely areolate (Fig. 150c) rather than punctate, ridged, or rugose, the punctures of the female mesothoracic venter are many diameters part (rather than about one diameter apart), those of the male mesopleuron several diameters part (rather than about one diameter apart, male unknown in *arrernte* and *politus*), male tergum VII with a few, sparse punctures (rather than densely punctate), the flagellum is black (rather than reddish brown). In addition, punctures of terga I

and II are excessively dense, less than one diameter apart and relatively large (Fig. 150d), setae of tergum I do not conceal the integument; the whitish yellow pygidial plate of many females is a subsidiary recognition feature. Unlike *arrernte* and *axillaris*, the orbital fovea is lacking in the female (rather than present, well defined), and the apical spine of foretarsomere II is longer than foretarsomere III (rather than shorter).

Description.— Frons with minutely punctate area along orbit that is broad ventrally and gradually narrows dorsad, ending below level of midocellus (punctures no more than one diameter apart); area above antenna impunctate, practically unsculptured (markedly larger in female than in male); remaining frons with punctures that in female are many diameters apart ventrally and about one or two diameters apart next to midocellus, interspaces in most females and many males merging into longitudinal, minute ridges (Fig. 149a); frontal line barely indicated on lower frons. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.8 × hindocellar width. Clypeus with impunctate, shiny, convex area just dorsad of lamella (Fig. 149c, d). Gena narrow as seen from above (Fig. 149b). Pronotal collar not attaining level of scutum (Fig. 150a), closely punctate (several punctures elongate). Scutal punctures less than one diameter apart, conspicuous laterally, smaller and elongate mesally; scutal flange ending abruptly. Horizontal part of axilla expanded, its lateral margin convex, overhanging its depressed part (Fig. 150b). Mesopleural punctures finer than those on scutum laterally, concealed by vestiture on large area in female, several diameters apart in male; interspaces unsculptured, shiny; punctures of mesothoracic venter many diameters apart in female. Propodeal dorsum conspicuously,

Figure 149. *Sericophorus pectinatus* Lomholdt, sp. nov.: a – female head in frontal view; b – female head in dorsal view; c – female clypeus in frontal view; d – male clypeus in frontal view.

finely areolate, adjacent to foremargin with deep, crenulate sulcus that extends mesally into well-defined, longitudinal sulcus; longitudinal sulcus glabrous, with a series of transverse carinae, anteriorly also with median carina that is about as long as midocellar width (Fig. 150c); side ridged or irregularly microsculptured, separated from posterior surface by longitudinal, zigzagging carina; posterior surface rugose (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell narrowed anteriorly. Forecoxal venter with a few, sparse punctures. Tergal punc-

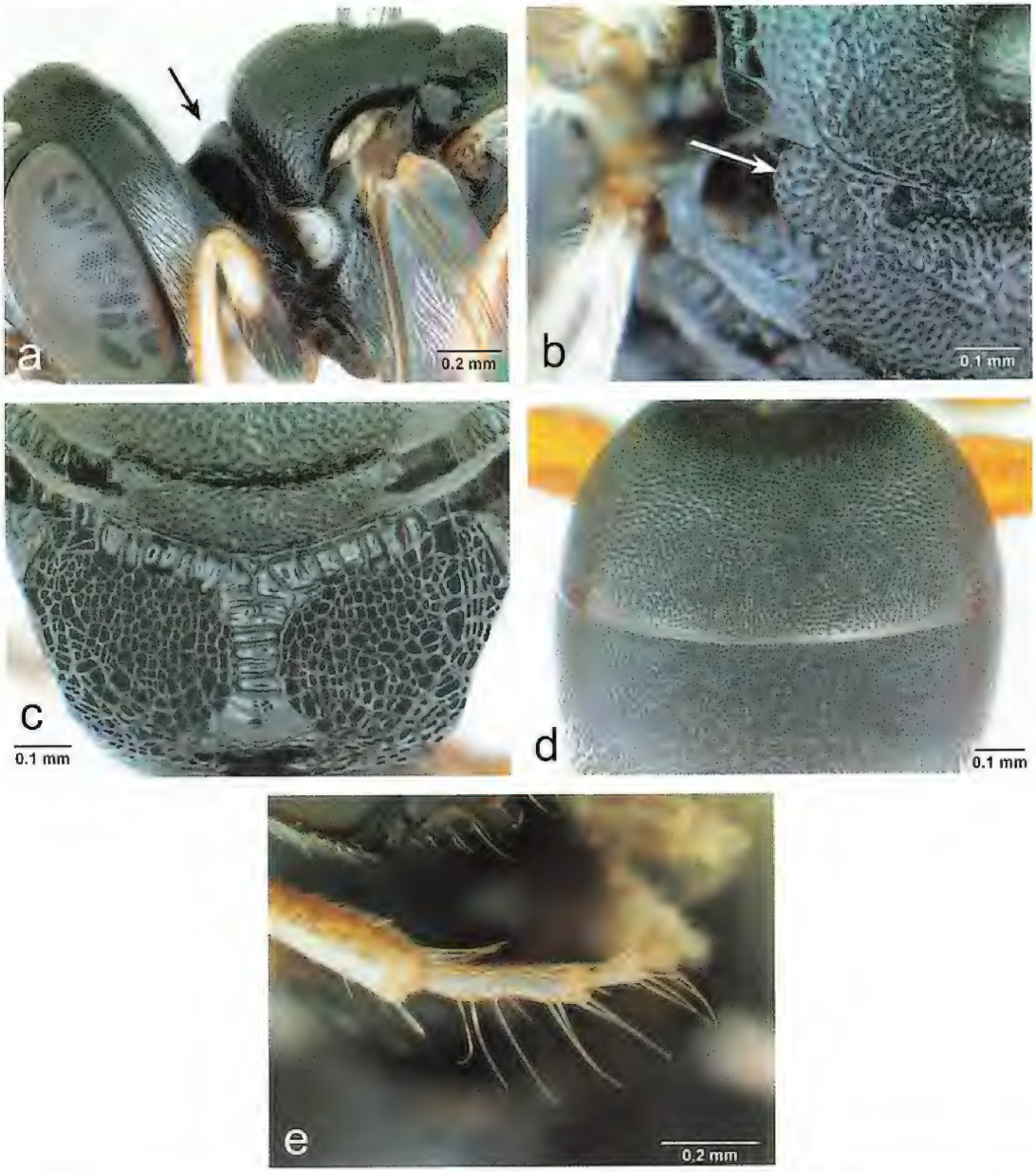

FIGURE 150. *Sericophorus pectinatus* Lomholdt, sp. nov.: a – posterior part of female head and anterior part of thorax in lateral view (arrow indicates pronotal collar not attaining level of scutum); b – part of female mesothorax in dorsal view (arrow indicates axilla); c – propodeal dorsum of female in dorsal view; d – tergum I of female and part of tergum II in dorsal view; e – part of female foretibia and foretarsus in dorsal view.

tures (except on apical tergum) relatively large, well defined, less than one diameter apart (Fig. 150d); apical depressions of terga punctate. Tergum I markedly concave anteriorly, concavity with punctures that are many diameters apart.

Setae silvery, not obscuring integument on lower frons or clypeus; appressed on upper frons, postocellar area, and scutum; inconspicuous, appressed, oriented anterad on propodeal dorsum. Fore- and midfemora with sparse, suberect setae; longest setae about equal to midocellar width on forefemur, about two thirds of midocellar width on midfemur.

Head, thorax, propodeum, and gaster black except the following: mandible brown to black basally, yellowish medially, dark brown apically; female flagellum yellow to brown ventrally; pronotal lobe largely whitish yellow; terga IV and V in many females (III-V in some) and in some males with narrow, preapical whitish yellow band; tergum VI of many females largely whitish yellow. Forefemur whitish yellow apically (yellow area longer ventrally than dorsally); mid- and hindfemora light brown (midfemur whitish yellow apicoventrally in some specimens); tibiae light brown ventrally, whitish yellow dorsally; tarsi whitish yellow.

♀.— Orbital fovea absent. Occipital carina concave in dorsal view. Dorsal length of flagellomeres I and II about 0.8 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X about 1.2 × basal width. Forebasitarsus with 5–7 thin rake spines, longest spines more than twice apical width of basitarsus (Fig. 150e). Pygidial plate shiny, with punctures that average several diameters apart in at least basal half (closely spaced apically); associated setae sparse, not obscuring integument. Length 3.6–3.9 mm.

♂.— Clypeal lamella with one lateral tooth. Dorsal length of flagellomeres I and II about 0.8 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with 3–5 rake spines, longest spines about 1.7 × apical width of basitarsus. Tergum VII shiny, with only a few, sparse punctures. Sternum VIII emarginate apically (Fig. 151a). Genitalia: Fig. 151b. Length 3.5–4.0 mm.

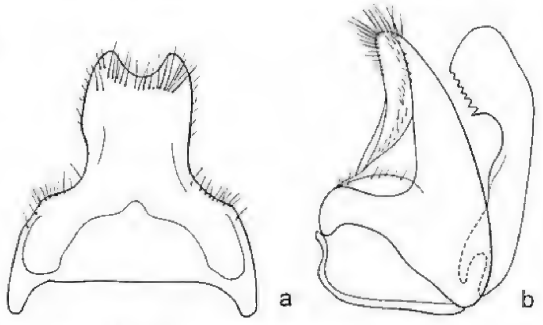

FIGURE 151. *Sericophorus pectinatus* Lomholdt, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 146).— Known from one locality in Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Western Australia**: 17 km WNW Balladonia Roadhouse at 32°17′S 123°28′E, 18 Sept 1981, I.D. Naumann and J.C. Cardale (ANIC). PARATYPES: same data as holotype (11 ♀, 7 ♂, ANIC; 2 ♀, 2 ♂, CAS).

Sericophorus politus Lomholdt, sp. nov.

Figures 146, 152.

NAME DERIVATION.— *Politus*, Latin masculine adjective meaning *smooth, shiny*; with reference to this species integument.

RECOGNITION.— The female of *politus* (the male in unknown) shares with *nitidus* a sparsely punctate frons (Fig. 152a, punctures several diameters apart except near orbit), scutal disk (Fig. 152c, punctures 3–4 diameters apart), and pygidial plate (Fig. 152d, puncture about 2–3 diameters apart), and a long foretarsal rake (Fig. 152e, apical spine of foretarsomere III longer than foretarsomere IV). It differs from *nitidus* in having the occipital carina not joining the hypostomal carina

(rather than joining), an expanded axilla whose outer margin is markedly convex, overhanging depressed lateral portion (rather than not expanded), the mesopleural setae as well developed above the scrobal sulcus as beneath it (rather than markedly finer above the scrobal sulcus than beneath it), the mesothoracic venter densely punctate (punctures 2–3 diameters apart rather than several diameters apart), and terga II-V with narrow, broadly interrupted, whitish apical fasciae (rather than all black). *Sericophorus sparsus* also has a sparsely punctate frons, but unlike *politus* the scutal punctures are close to each other.

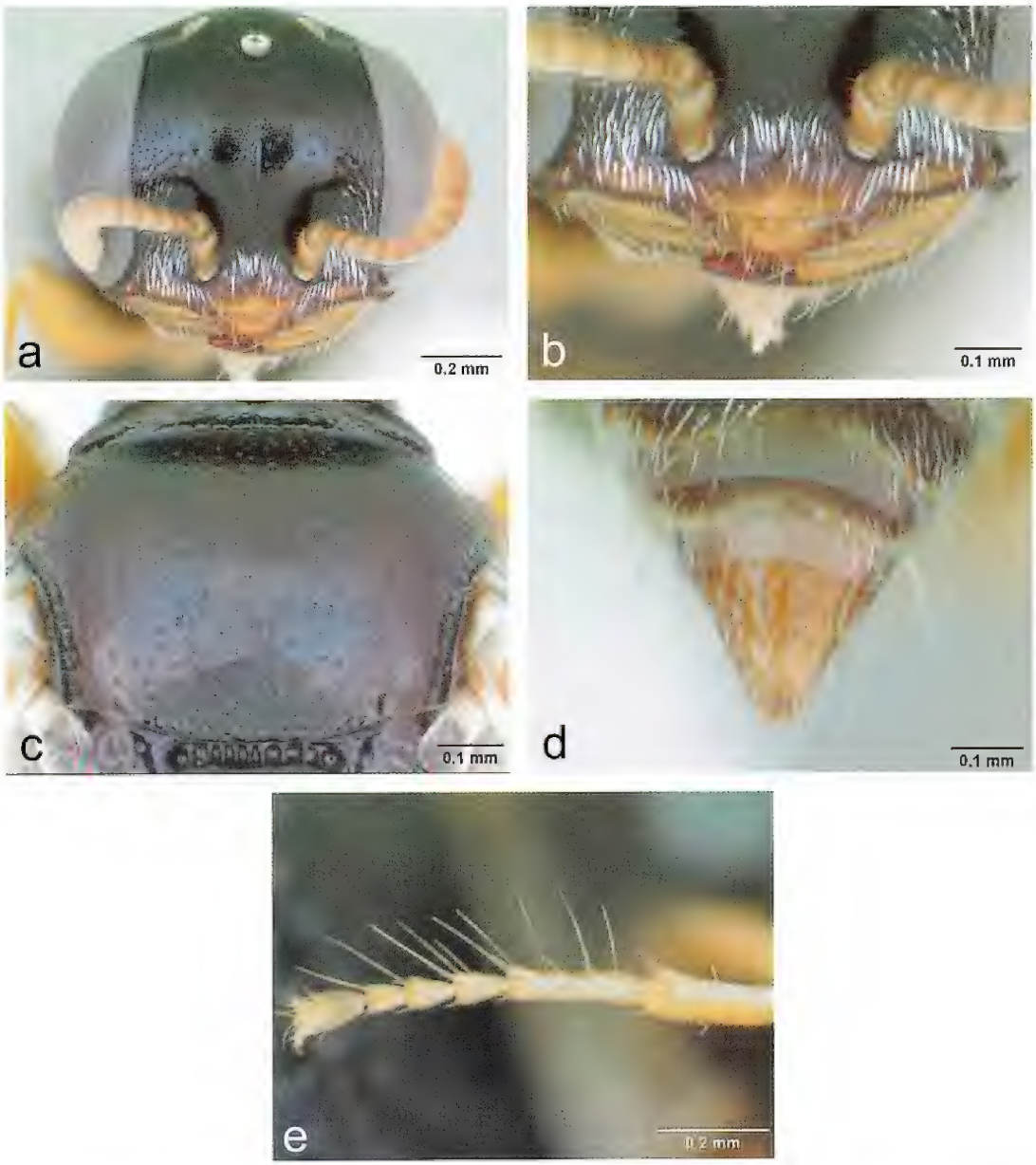

FIGURE 152. *Sericophorus politus* Lomholdt, sp. nov.: a – female head in frontal view; b – female clypeus in frontal view; c – female scutum in dorsal view; d – pygidial plate in female in dorsal view; e – female foretarsus.

Description (based on holotype only).— Inner orbits practically parallel. Occipital carina not joining hypostomal carina. Most frontal punctures many diameters apart (those adjacent to orbit, up to about orbit midheight, about one diameter apart). Frontal line absent. Antennal socket separated from clypeal free margin by socket width. Ocellocular distance equal to about 0.8 × hindocellar width. Middle clypeal section with a few, sparse punctures (Fig. 152b). Pronotal collar not reaching level of scutum. Scutal punctures on disk conspicuous, several diameters apart (Fig. 152c); interspaces practically unsculptured; scutal flange ending abruptly. Mesopleural punctures about one diameter apart. Propodeal dorsum rugose, with glabrous median sulcus but no median carina; side ridged; longitudinal carina present between side and posterior surface; posterior surface ridged (except for median sulcus). Forewing vein M diverging from M+Cu slightly distally to cu-a; second submarginal cell narrowly open anteriorly. Forecoxal venter shiny, with a few, sparse punctures. Foretarsal rake elongate (see below for details). Tergum I concave anteriorly, punctures of horizontal area well defined, about two diameters apart; apical depression punctate; apical depression of tergum II punctate. Sternum I with bifurcating ridge.

Setae of clypeus silvery, partly obscuring integument on lateral section; inconspicuous, appressed on upper frons, postocellar area, and scutum; appressed, fully concealing integument on mesopleuron; appressed on propodeal dorsum, oriented anterad.

Head, thorax, propodeum, and gaster black except ventral part of clypeus yellowish brown, mandible yellow (brown apically), flagellum reddish brown dorsally, yellow ventrally, pronotal lobe reddish brown posteriorly, terga II-V with whitish, broadly interrupted apical fasciae, and tergum VI reddish brown, yellow apically. Tegula and wing veins pale yellow. Forecoxa black, mid- and hindcoxae and all femora yellowish brown; tibiae yellow, yellowish brown ventrally; tarsi yellow.

♀.— Orbital fovea absent. Clypeal lamella with two lateral teeth on each side (Fig. 152b). Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with five rake spines, length of apical spine 2.4 × basitarsus apical width, apical spine of tarsomere III nearly reaching claw base (Fig. 152e). Punctures of pygidial plate 2–3 diameters apart (Fig. 152d). Length 3.1 mm.

♂.— Unknown.

Geographic distribution (Fig. 146).— Known from two localities, one in Queensland and one in Western Australia.

Records.— Holotype: ♀, **AUSTRALIA: Western Australia**: Carnarvon area, 2–4 Jan 1975, E.M. Exley and R.I. Storey (ANIC). Paratype: **AUSTRALIA: Queensland**: 2 km N Rokeby at 13°39′S 142°40′E, 24 June–15 July 1983 (1 ♀, ANIC).

Sericophorus protrudens Lomholdt, sp. nov.

Figures 153, 154.

Derivation of name.— *Protrudens*, the present participle of the Latin verb *protrudere*, to project, here used as an adjective.

Recognition.— *Sericophorus protrudens* can be recognized by the following combination: setae erect on the upper frons and postocellar area, basal declivity of tergum I concave, most of the head, thorax, propodeum, and gaster metallic bluish green, and the legs contrastingly yellowish red. Also, the scutellum is evenly convex, the propodeal dorsum is punctate rather than rugose or ridged, the propodeal side is separated from the posterior surface by a series of oblique ridges but no longitudinal ridge, and the lateral tooth of the clypeal lamella is prominent (Fig. 153). *Seri-*

cophorus evansi is similar, but in that species most of the femora are bluish green, the outer lateral tooth of the clypeal lamella is nonprominent, and the propodeal dorsum is unsculptured, shiny between punctures (microsculptured, dull in *protrudens*). *Sericophorus viridescens* is also similar, but has the median sulcus of the propodeal dorsum about as wide as the length of the metanotum (markedly narrower than length of metanotum in *protrudens*).

Figure 153. *Sericophorus protrudens* Lomholdt, sp. nov.: female clypeus in frontal view.

Status of the species.— Lomholdt recognized *Sericophorus protrudens* as a full species, but in fact it is identical to *littoralis* except for its metallic green frons and gena. It may be a color form of the latter, especially because both forms occur at Goongarrie, Western Australia. Intergradation, however, has not been observed.

Description.— Frons swollen near center; frontal punctures about 1–2 diameters apart, several diameters apart near center; frontal line inconspicuous, reaching anterior ocellus; interocellar area convex adjacent to hindocellus, concave mesally. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.2–1.3 × hindocellar width. Lateral tooth of clypeal middle lobe prominent (Fig. 153). Scutal punctures about 2–3 diameters apart (less than one diameter apart near margins); scutal flange widest preapically, gradually narrowing toward apex. Scutellum markedly convex, at center unsculptured between punctures. Mesopleural punctures 2–3 (paratype from Merredin, Western Australia) to several (holotype) diameters apart. Propodeal dorsum punctate (punctures about one diameter apart, interspaces microareolate); adjacent to foremargin with deep, crenulate sulcus that extends mesally into well-defined, longitudinal sulcus; the latter glabrous, with several transverse carinae, anteriorly also with median carina; side conspicuously microsculptured, impunctate, separated from posterior surface by oblique ridges (with no longitudinal ridge); posterior surface conspicuously microsculptured, with several fine, transverse carinae (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell markedly narrowed anteriorly. Tergal punctures averaging about one diameter apart; anterior declivity of tergum I concave; apical depressions of terga I and II punctate.

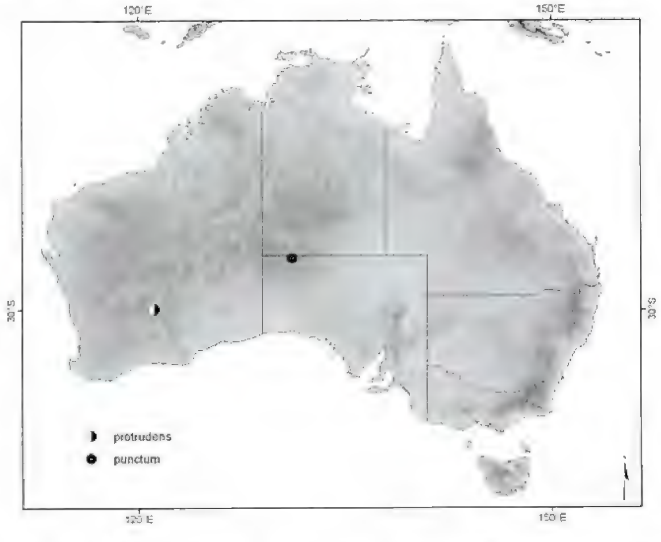

Figure 154. Collecting localities of *Sericophorus protrudens* and *punctum*.

Setae silvery on frons and clypeus, not obscuring integument; erect on upper frons and postocellar area, on interocellar area as long as midocellar width;

on scutum dark, about as long as 0.7 of midocellar width; suberect on propodeal dorsum.

Head, thorax, propodeum, and gaster metallic bluish green except upper frons black in specimen from Goongarrie and the following are yellowish red: clypeus largely, antenna, mandible (dark brown apically), pronotal lobe, and gastral segment VI. Legs yellowish red.

♀.— Lateral tooth of clypeal lamella conspicuous. Orbital fovea matt, black, not impressed, slightly narrower than half ocellocular distance. Dorsal length of flagellomeres I and II about 1.3 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X about 1.1 × basal width. Forebasitarsus with six or seven rake spines. Setae of pygidial plate not obscuring integument. Length 7.5–8.5 mm.

♂.— Unknown.

Variation.— The specimen from Goongarrie, Western Australia differs in having the ridges between the propodeal side and posterior surface relatively small and the integument dark violet.

Geographic distribution (Fig. 154).— Western Australia.

Records.— Holotype: ♀, **AUSTRALIA: Western Australia**: Merredin, 12–13 Dec 1935 (BMNH). Paratypes: **AUSTRALIA: Western Australia**: same data as holotype (1 ♀, CAS); Goongarrie at 29°55′S 121°08′E, Oct 1980, W.F. Humphreys (1 ♀, WAMP).

Sericophorus pulawskii Ohl

Figures 155, 156.

Sericophorus pulawskii Ohl, 2009:28, ♀. Holotype: ♀, New Caledonia: Forêt Nord at 22°19′S 166°55′E (MNHN), examined by W. Pulawski.

Recognition.— *Sericophorus pulawskii* is an all black species (except for a reddish brown inner foretibial surface), with appressed setae on the frons and postocellar area, and with a conspicuous, conical prominence on tergum I on which the spiracle is located (as in Fig. 168d, f). It differs from *rhinoceros* by a significantly lower middle clypeal projection that is shorter than the scape (compare Figs 155b and 168b).

Relationship to *Sericophorus rhinoceros*.— *Sericophorus pulawskii* is practically identical to *rhinoceros* except for a conspicuously lower middle clypeal projection. The projection, however, is markedly higher in the

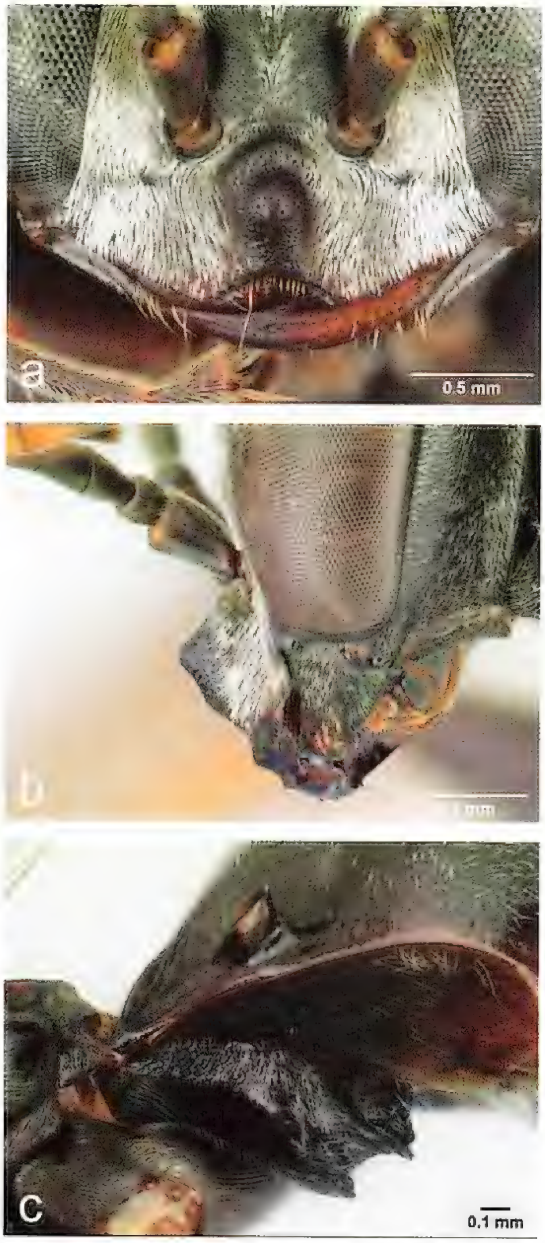

Figure 155. *Sericophorus pulawskii* Ohl ♀: a – female clypeus in frontal view; b – female clypeus in lateral view; c – base of gastral segment I in lateral view.

holotype than in the paratype, suggesting considerable variation exists. It is thus not impossible that the two species are connected by a continuous range of intermediate forms, and that they are just extreme forms of one species.

Description.— Frontal punctures minute, less than one diameter apart mesally. Frontal line extending to about frons midheight. Ocellocular distance equal to 1.1 × hindocellar width. Interocellar area convex adjacent to hindocellus, concave mesally. Posteroventral mandibular tooth rounded. Propleuron prominent posterolaterally, prominence oriented anterad. Scutal punctures near center averaging about two diameters apart; scutal flange narrowing gradually toward apex. Mesopleural punctures near center averaging about two diameters apart; episternal sulcus not foveolate. Propodeal dorsum finely punctate, crenulate along foremargin, with shallow, ill-defined median sulcus, without median carina; side conspicuously microsculptured and with minute, scattered punctures, not separated from posterior surface by longitudinal carina or oblique carinae; posterior surface finely punctate except for median sulcus area. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell narrowly opened. Tergum I concave anteriorly, with basolateral carina effacing behind spiracle; also with conspicuous, conical prominence between carina and laterotergite (as in Fig. 168d); spiracle slit-like (as in Fig. 168f); punctures of horizontal area several diameters apart; apical depression impunctate in posterior half; apical depression of tergum II impunctate near apex. Sternum I with prominent bulge, bulge broad in lateral view, concave ventrally (Fig. 155c).

Setae of lower frons and clypeus silvery, obscuring integument (except on median convexity); appressed on upper frons, postocellar area, and scutum; inclined anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except mandible reddish brown medially and flagellomeres IV-X or V-X yellowish ventrally. Legs black except foretibia reddish brown (dark brown on outer side). Wings infumate except nearly hyaline basally.

♀.— Orbital fovea ill defined, about as wide as half ocellocular distance. Middle clypeal section with rounded tubercle that is higher in holotype (Fig. 155a, b) than in paratype; lamella perpendicular to remaining clypeus (thus invisible in frontal view), without lateral teeth. Dorsal length of flagellomeres I and II 1.3 × apical width; greatest length of flagellomere IX 0.9 × apical width; greatest length of flagellomere X 1.7 × basal width. Forebasitarsus with eight or nine rake spines. Setae of pygidial plate completely concealing integument in apical half. Length 10.9–11.2 mm.

♂.— Unknown.

Geographic distribution (Fig. 156).— New Caledonia.

Records.— NEW CALEDONIA: Forêt Nord at 22°19′S 166°55′E, 1–22 Dec 2004 (1 ♀, MNHN, holotype); Mount Mandjélia 5 km WSW Puébo at 20°24′S 164°32′E, 27 Nov 2000 (1 ♀, INHS, paratype).

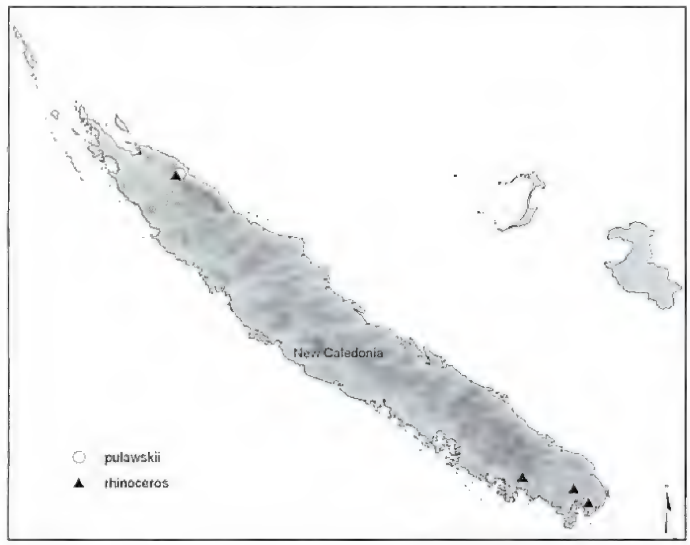

Figure 156. Collecting localities of *Sericophorus pulawskii* and *rhinoceros*.

***Sericophorus punctum* Lomholdt, sp. nov.**
Figures 154, 157.

NAME DERIVATION.— *Punctum*, Latin for *little hole*, *puncture*; with reference to this species small size; a noun in apposition to the generic name.

RECOGNITION.— *Sericophorus punctum* is a small species (length about 3.2 mm), without outstanding recognition features. It is characterized by the thorax, propodeum and gaster black (without yellow markings or metallic luster), the setae appressed on the head and thorax, the frons densely punctate, the clypeus not emarginate and without elevation, the pronotal collar not emarginate, the axilla lateral margin not expanded, the pronotal dorsum without a sublateral carina, presence of three submarginal cells, the forecoxa black, the hindtibia not swollen, the basolateral carina of tergum I ending well before the anterior margin of the spiracle, tergum II with impunctate apical depression, and sternum I without projection. It resembles *iridipennis*, *striatulus*, and *vicarius* in having a finely ridged propodeal dorsum. The female of *punctum* is unknown, but the male differs from *striatulus* by its much smaller size (body length about 3.2 mm rather than 7.5 mm), the apical flagellomere as long as 1.2 × its basal width (rather than 2.0 ×), the pronotal collar not reaching the level of the scutum (reaching in *striatulus*), and the ridges of the propodeal dorsum being oblique (rather than longitudinal). Unlike *iridipennis* and *vicarius*, the male of *punctum* has the clypeal lamella angulate laterally (Fig. 157b), whereas not angulate in the other two species, and the head width is 1.3 × length (Fig. 157a), length measured from midpoint of clypeal free margin to top of vertex (rather than less than 1.2 ×); although the difference in proportions is only slightly more than 0.1, the difference in shape is obvious when specimens are compared.

DESCRIPTION (based on holotype only).— Head transverse (Fig. 157a), width 1.3 × length measured from the tip of the clypeus to the top of the vertex. Frontal punctures nearly contiguous. Frontal line present only on lower frons. Antennal socket separated from clypeal free margin by socket width. Ocellocular distance equal to 1.2 × hindocellar width. Pronotal collar not reaching level of scutum. Scutal punctures about 1–2 diameters apart; scutal flange ending abruptly. Axilla slightly overhanging depressed, lateral portion, but with straight lateral margin. Mesopleural punctures evanescent several diameters apart beneath scrobe. Propodeal dorsum finely, obliquely ridged, with median carina; side finely ridged; posterior surface finely ridged laterally, unsculptured on each side of median sulcus. Forewing vein M diverging from M+Cu slightly distad of cu-a; second submarginal cell narrowly open anteriorly. Tergum I: punctures of horizontal area 3–4 diameters apart; apical depression with minute, sparse punctures; apical depression of tergum II impunctate.

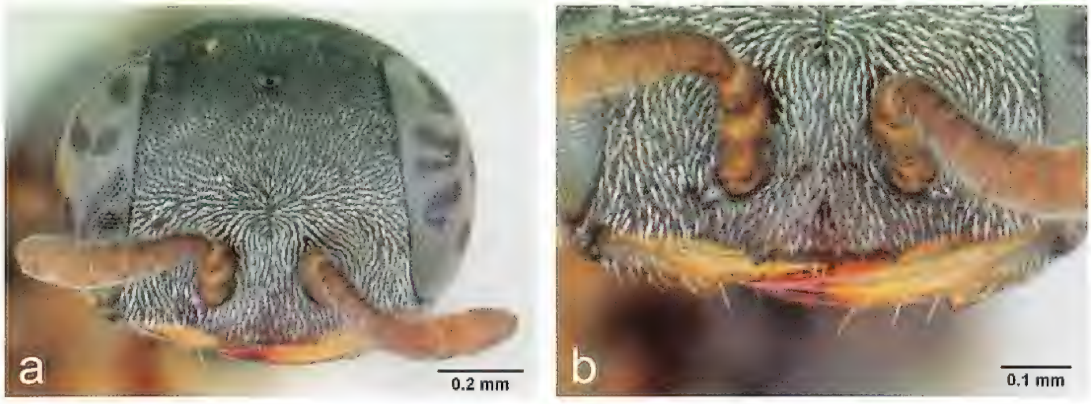

FIGURE 157. *Sericophorus punctum* Lomholdt, sp. nov.: a – male head in frontal view; b – male clypeus in frontal view.

Setae of lower frons and clypeus silvery, not obscuring integument; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum (propodeal dorsum narrowly glabrous mesally).

Head, thorax, propodeum, and gaster black except mandible yellow (reddish apically) and flagellum dark brown dorsally and light brown ventrally. Forefemur brown except yellowish in apical third or so, midfemur brown, yellowish dorsally and apically, hindfemur brown basally, light brown apically; tibiae, and tarsi yellowish brown.

♀.— Unknown.

♂.— Clypeal lamella angulate on each end (Fig. 157b). Orbital fovea well defined, narrower than half ocellocular distance. Dorsal length of flagellomere I about 1.1 × apical width, of flagellomere II about 0.8 × apical width; greatest length of flagellomere IX 0.5 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with no fewer than three rake spines (apical spine or spines missing). Sternum VIII: Fig. 158a. Genitalia: Fig. 159b. Length about 3.2 mm.

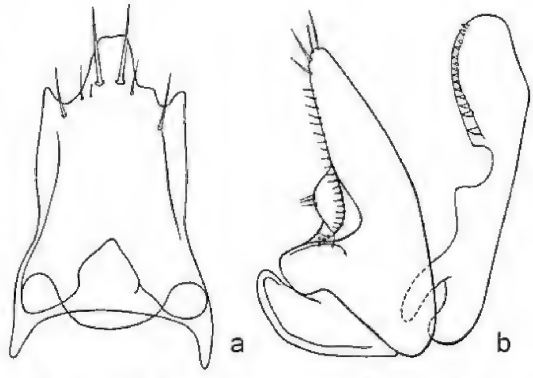

FIGURE 158. *Sericophorus punctum* Lomholdt, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 154).— Known from one locality in South Australia.

RECORDS.— HOLOTYPE: ♂, **AUSTRALIA**: **South Australia**: Mt. Davies in Tompkinson Range, 18–21 Oct 1972, H.E. Evans (USNM).

Sericophorus pusillus (Hacker and Cockerell)

Figures 159, 161.

Zoyphium pusillum Hacker and Cockerell, 1922:288, ♂. Holotype: Australia: Queensland: Brisbane (QMB), examined by O. Lomholdt and W. Pulawski.— As *Sericophorus pusillus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:253 (in catalog of Australian Sphecidae).

RECOGNITION.— *Sericophorus pusillus* has a reddish brown pronotum (pronotal lobe pale yellow), a black, nonmetallic scutum and scutellum, a yellow clypeus and forecoxal venter, and the setae appressed on the upper frons and postocellar area. The erect setae on male sterna are a subsidiary recognition feature.

DESCRIPTION.— Inner orbits parallel. Frontal punctures minute, ill defined, about one diameter apart; frontal line ill defined. Frontal line present just below frons midheight, shorter to slightly longer than midocellar width. Free margin of clypeal lamella arcuate (Fig. 159a. b). Antennal socket separated from clypeal free margin by less than two socket widths. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.7–1.0 × hindocellar width. Scutal punctures about one diameter apart; scutal flange widest apically, ending abruptly. Mesopleural punctures about one diameter apart below scrobe, interspaces unsculptured. Propodeal dorsum punctate, next to anterior margin with conspicuous ridges that become gradually evanescent, with sharp median carina in shallow, glabrous, longitudinal depression; side shiny, sparsely punctate and with evanescent ridges, impunctate anteriorly; posterior surface punctate except for median sulcus. Forewing vein M diverging from M+Cu basad of cu-a or interstitial with latter; second submarginal cell triangular, narrowly open in some specimens. Terga minutely punctate; horizontal area of tergum I with punctures that are several diameters apart (at least apicomesally), apical depression impunctate.

Setae of lower frons and clypeus silvery or with golden tinge, not completely concealing integument; appressed on upper frons, postocellar area, and scutum; on propodeal dorsum appressed, oriented anterad (dorsum asetose apicomesally).

Head, thorax, and propodeum black except the following: clypeus yellow (dark basally in some females), yellowish red in some males, narrowly brown along lamella; antenna yellowish brown to reddish yellow, slightly darkened dorsally; mandible yellow, with apex brown; pronotum reddish brown (with dark transverse spot mesally in some specimens), pronotal lobe pale yellow; metanotum brown to reddish brown in several Western Australian females. Legs yellowish brown to brown, forecoxa pale yellow. Gaster reddish brown in most populations, terga black laterally in females and some males from Northern Territory; gaster all black in some females from New South Wales and in some males from Northern Territory.

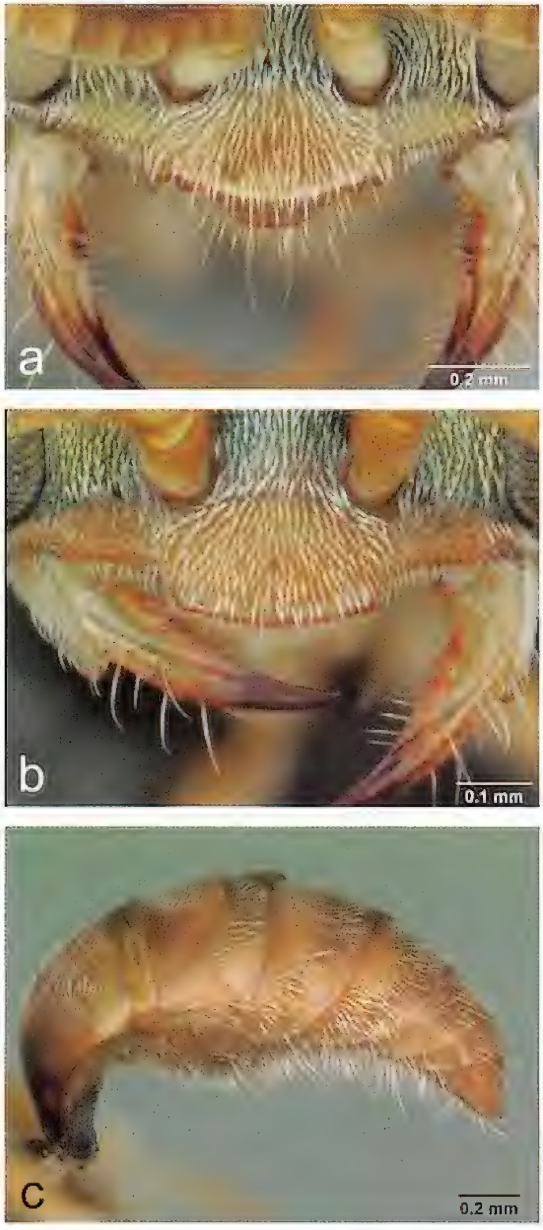

FIGURE 159. *Sericophorus pusillus* (Hacker and Cockerell): a – female clypeus in frontal view; b – male clypeus in frontal view; c – male gaster in lateral view.

♀.— Orbital fovea absent or ill defined, wider than half ocellocular distance. Dorsal length of flagellomere I 1.0–1.3 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 1.0 × apical width, of flagellomere X 1.6–1.8 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate not concealing integument. Length 4.9–6.8 mm.

♂.— Clypeal lamella angulate laterally but without tooth (Fig. 159b). Dorsal length of flagellomeres I and II about 0.7 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.3 × basal width. Foretarsomere with five rake spines. Sterna with conspicuous, erect setae that are about as long as midocellar width in most populations, about half of midocellar width in those from Northern Territory (Fig. 159c). Sternum VIII:

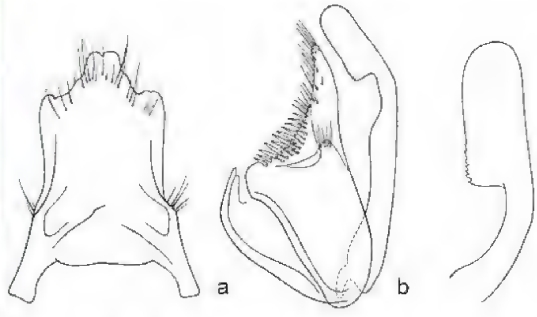

FIGURE 160. *Sericophorus pusillus* (Hacker and Cockerell): a – sternum VIII of male; b – male genitalia in lateral view, with outline of penis valve.

Fig. 160a. Genitalia: Fig. 161b. Length 3.8–6.8 mm.

Geographic distribution (Fig.161).— New South Wales, Queensland, Northern Territory, and Western Australia.

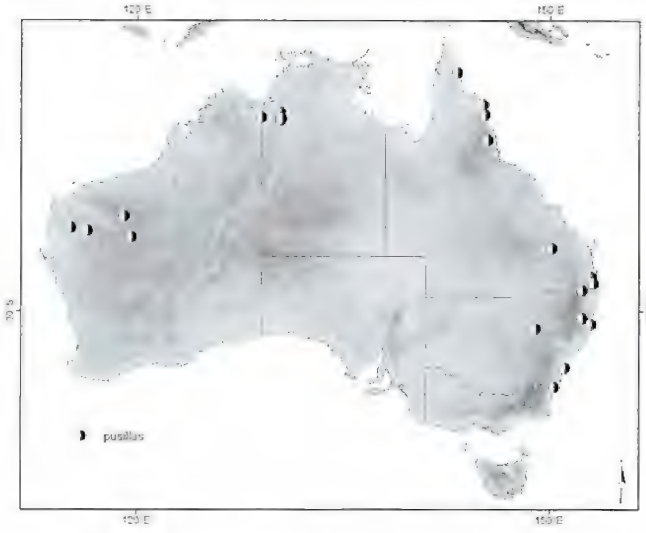

FIGURE 161. Collecting localities of *Sericophorus pusillus*.

Records.— AUSTRALIA: New South Wales: Kioloa State Forest 15 km NE Batemans Bay at 35°30′S 150°18′E, Nov 1986 (1 ♀, ANIC, gaster black); New England National Park via Ebor, 22–23 Jan 1966 (1 ♀, UQIC, gaster black); Rainbow Beach, Oct (1 ♂, AEI); Royal National Park near Sydney, 17 Mar 1977 (1 ♀, AMS, gaster black); Toolooma Plateau 14 km W Urbenville at 28°29′S 152°24′E, 14 Feb 1986 (1 ♀, ANIC, gaster black); Warrumbungle National Park at 31°16′S 148°58′E, 20 Dec 1987and 12–16 Dec 1995 (2 ♂, UCD), 17 Dec 1995 (1 ♀, ZMHU). **Northern Territory**: Gregory National Park at 15°36′43″S 130°24′08″E, 6–12 June 2001 (2 ♀, 1 ♂, CAS; 5 ♀, USU) and 15–18 June 2001 (1 ♀, 1 ♂, CAS), at 16°06′42″S 130°25′23″E, 24 May–5 June 2001 (1 ♀, CAS), at 16°06.6′S 130°25.7′E, 24 May–4 June 2001 (1 ♀, CAS; 1 ♀, USU) and 12–16 June 2001 (1 ♀, USU), at 16°08.9′S 130°26.6′E, 5–12 June 2001 (1 ♀, USU), at 16°08′52″S 130°26′38″E, 13–15 June 2001 (1 ♀, USU), at 16°09.8′S 130°26.5′E, 5–12 June 2001 (1 ♀, USU), at 16°06′35″S 130°25′39″E (1 ♂, USU), at 16°02.4′S 130°27.3′E, 24 May–6 June 2001 (1 ♀, 1 ♂, USU), at 16°02′26″S 130°29′18″E, 24 May 2001 (2 ♀, USU); Keep River National Park at 15°57′33″S 129°01′44″E, 31 May–3 June 2001 (1 ♀, CAS). **Queensland**: Boggomoss via Taroom at 25°27′S 150°08′E, 13 Nov 1996 (1 ♀, QMB); Brisbane, 3 Oct 1916 (1 ♂, QMB, holotype of *Zoyphium pusillum*); Brisbane Forest Park at 27°25′S 152°50′E, 4 Jan –2 Feb 1999 (1 ♀, CAS); Iron Range at 12°45′46″S 143°17′10″E (1 ♀, UQIC); Moses Creek 4 km NE Mt. Finnigan at 15°47′S 145°17′E, 14–16 Oct 1980 (1 ♂, ANIC); 3 km ENE Mount Tozer at 12°44′S 143°14′E, 28 June–4 July 1986 (1 ♀, ANIC); 9 km ENE Mount Tozer at 12°43′S 143°17′E, 5–10 July 1986 (1 ♀, ANIC); Mount Tamborine: Thunderbird Park, 16 Nov 1972 (1 ♂, FSCA); 3 km NE of Mount Webb, 15°03′S 145°09′E, 1–3 Oct 1980 (3 ♂, ANIC; 2 ♂, CAS); Ravenshoe State Forest: Tully Falls Road (1 ♀, ANIC). **Western Australia**: 10 km W Cobra Station at 24°10.2′S 116°23.0′E, 26 Apr–10 May 2003 (1 ♂, ANIC; 1 ♂, USU); Great Northern Highway 82 km S junction with Karijini Drive at 23°07.3′S 119°05.5′E, 23 Apr–16 May 2003 (1 ♀, USU) and 6–17 May 2003 (1 ♀, USU); Kennedy Range National Park at 23°56.8′S 115°10.4′E, 26 Apr–10 May 2003 (1 ♂, ANIC; 5 ♀, 1 ♂, USU); 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003 (53 ♀, ANIC; 10 ♀, CAS; 35 ♀, USU) and 18–21 May 2003 (3 ♀, ANIC; 1 ♀, CAS; 1 ♀, USU).

Sericophorus relucens F. Smith

Figures 162–164.

Sericophorus relucens F. Smith, 1856:357, ♀. Holotype: ♀, Australia: South Australia: Adelaide (BMNH), examined by O. Lomholdt.— Froggatt, 1892:221 (in catalog of Australian Hymenoptera); Dalla Torre, 1897:578 (in catalog of world Sphecidae); Turner, 1914:350 (in revision of *Sericophorus*, description of ♂); Rayment, 1955a:41 (in revision of *Sericophorus*); Matthews and Evans, 1971:427 (nesting habits); Bohart and Menke, 1976:302 (listed); Cardale, 1985:248 (in catalog of Australian Sphecidae); McCorquodale, 1988a:121 (prey); McCorquodale and Thomson, 1989:95 (citation of Matthews and Evans, 1971); Radović and Sušić, 1997:537 (sting structure).

Zoyphidium rufipes Rohwer, 1911b:585, ♀ Holotype: ♀, Australia: Queensland: Duaringa (USNM), exam-

ined by O. Lomholdt. **New synonym by O. Lomholdt.**— As questionable synonym of *Sericophorus relucens*: Turner, 1914:350; Bohart and Menke, 1976:302.

Sericophorus carinatus Rayment, 1955a:26, ♀. Holotype: ♀, Australia: Victoria: Sandringham (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:245 (in catalog of Australian Sphecidae).

Sericophorus relucens nigricornis Rayment, 1955a:43, ♀. Lectotype: ♀, Australia: Queensland: 25 mi. E Durham Downs (ANIC); **present designation by O. Lomholdt,** examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:249 (in catalog of Australian Sphecidae).

Sericophorus relucens ruficornis Rayment, 1955a:44, ♀. Holotype: ♀, Australia: Northern Territory: Tennants Creek (SAM), examined by O. Lomholdt [who incorrectly designated this specimen as lectotype]. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:249 (in catalog of Australian Sphecidae).

Sericophorus rufobasalis Rayment, 1955a:46, ♂. Holotype: ♂, Australia: Queensland: Brisbane (QMB, now lost), examined by O. Lomholdt. Neotype: ♂, Australia: Queensland: Cairns (SAM), **present designation by W. Pulawki. New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:249 (in catalog of Australian Sphecidae).

LECTOTYPE SELECTION AND TYPE MATERIAL.— In the original description of *relucens ruficornis*, Rayment says "Type specimen, Tennants Creek, Central Australia, leg. J.F Field. Darwin, Northern Territory, leg. W.K. Hunt" and "Type in the collection of the South Australian Museum". The specimen from Tennants Creek is in the SAM, and it should be regarded as the holotype. O. Lomholdt incorrectly designated it as the lectotype. The paratype of *relucens ruficornis* from Darwin, Northern Territory (NMV), incorrectly designated as paralectotype by O. Lomholdt, is labeled "Holotype", clearly in error.

The holotype of *Sericophorus rufobasalis* was examined by Ole Lomholdt, but W. Pulawski could not find it in the material received for study or locate it in QMB. It is presumably lost. A neotype is here designated, a male paratype from Cairns, Queensland, A.M. Lea, carrying the red label "Type" in Rayment's handwriting and additionally labeled *Sericophorus relucens* subsp. *rufobasalis* ♀ Raym. (South Australian Museum). It was mentioned as "Typical male" in the original description.

Three specimens labeled as paratypes by Rayment are not mentioned in the original descriptions and cannot be regarded as paratypes. They are: *carinatus*, a female from Sandringham,Victoria (NMV); *ruficornis*, a female from Townsville, Queensland (NMV); *rufobasalis*: a female from Bolgart, Western Australia (NMV).

JUSTIFICATION OF NEW SYNONYMY.— *Sericophorus carinatus* was differentiated from *relucens* on the basis of "spoonlike short mandibles". In reality, the mandibles are simply worn off in the holotype. *Sericophorus relucens nigricornis* and *relucens ruficornis* are just color forms that fully intergrade (as noted by Rayment himself). The type series of *Sericophorus rufobasalis* consists only of males that were treated and labeled as females by Rayment; he thought that the reddish tergum I is a specific difference, whereas in reality it is normal for most males of *relucens*.

RECOGNITION.— *Sericophorus relucens* has a distinctive coloration: the pronotum is tricolored (Fig. 162c, black anteriorly, reddish mesally, yellow posterolaterally), the clypeus is black, and the scutellum and metanotum are reddish (Fig. 162b). The coloration is similar in *sericeus* in which, however, the middle clypeal section is elevated and tergum I has a conspicuous, lateral, spine-like projection (clypeus not elevated and tergum I without projection in *relucens*). Also distinctive for *relucens* is the propodeal dorsum, delimited by a sulcus at least posterolaterally (Fig. 162d), as is the absence of erect setae on the postocellar area, combined with the presence of a deep median sulcus on the propodeal dorsum. Subsidiary recognition characters of *relucens* are: posto-

cellar area with obtuse median tubercle just behind hindocelli, propodeal side separated from dorsum and posterior surface by a well-defined carina that extends from the spiracle to the base of the hindcoxa and is not crossed by transverse carinae, and the horizontal portion of tergum I is sparsely punctate and setose, markedly contrasting with the densely punctate and setose basal portion of tergum II (Fig. 162c).

Description.— Inner orbits nearly parallel in male. Frontal punctures less than one diameter apart; lower frons depressed around antennal socket; frontal line present in most specimens, shiny,

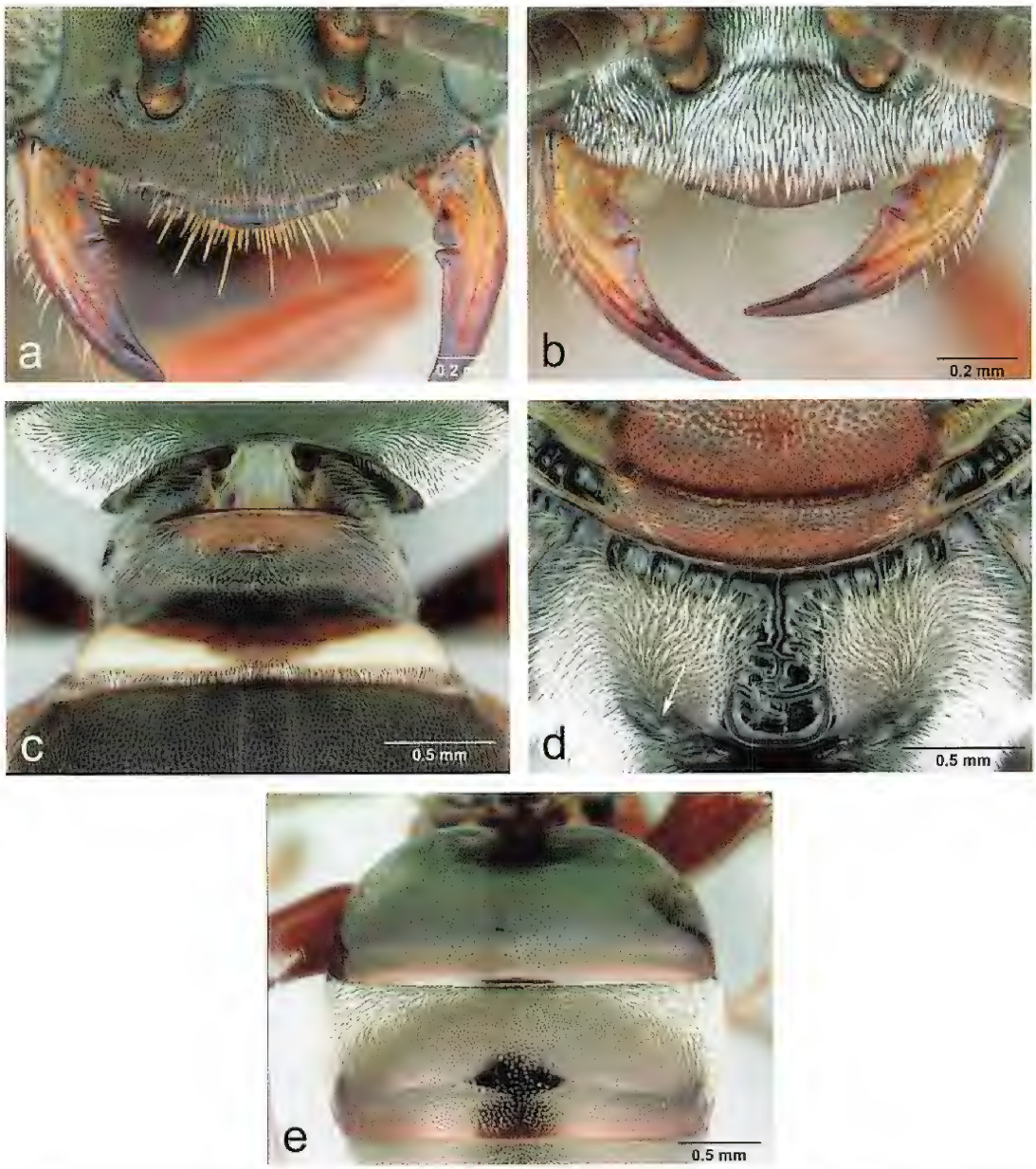

Figure 162. *Sericophorus relucens* F. Smith: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female pronotum in dorsal view; d – part of female scutellum, metanotum, and propodeal dorsum in dorsal view (arrow indicates lateral carina); e – female terga I and II in dorsal view.

in some specimens extending on clypeus as low carina. Postocellar area mesally with low, obtuse, shiny tubercle just behind hindocelli. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to hindocellar width. Clypeal lamella widely arcuate (Fig. 162a, b). Pronotal collar in some specimens with rudimentary median emargination. Propleuron somewhat expanded posterolaterally. Scutal punctures less than one diameter apart; interspaces shiny; scutal flange widest apically, ending gradually. Mesopleural punctures beneath scrobe one diameter apart or more; interspaces unsculptured, shiny. Propodeal dorsum densely, finely punctate; adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, glabrous, longitudinal sulcus; longitudinal sulcus parallel-sided or slightly widening posteriorly, delimited laterally and posteriorly by sharp carina; median carina sharp anteriorly, irregular posteriorly, connected to lateral margin of sulcus by transverse ridges (Fig. 162d); enclosure delimited by deep sulcus at least posterolaterally (Fig. 162d), sulcus either foveolate or simple; side punctate, shiny, with oblique ridges mesally, delimited from dorsum and posterior surface by sharp carina that extends from spiracle to base of hindcoxa and may be prominent near end of dorsum; posterior surface punctate, with unusually wide median sulcus (dorsally wider than midocellar width), delimited laterally by conspicuous carina. Forewing vein M diverging from M+Cu basad of cu-a in most specimens, interstitial with cu-a in some, exceptionally diverging distad of cu-a; second submarginal cell triangular or nearly so. Terga I and II at center preapically with punctures that are several and many diameters apart, respectively, narrowly unsculptured along posterior margin; anterior declivity of tergum I slightly concave.

Setae appressed on frons, not concealing integument, dark brassy in female, silvery in male; appressed on upper frons, postocellar area, and scutum; on scutum appressed, dark golden to coppery, lighter along posterior margin; on propodeal dorsum appressed, oriented anterad (median sulcus asetose).

Head, thorax, and propodeum black except the following: middle clypeal section in female narrowly reddish brown along lamella; antenna reddish brown ventrally, remainder black to reddish brown, apical flagellomere darkened apically; mandible yellowish red, apex dark reddish to black, base yellowish to brownish; pronotum black anteriorly, reddish with a pair of lateral yellowish spots posteriorly (specimens from Coinston, Northern Territory, have basolateral reddish markings); pronotal lobe, scutellum and metanotum reddish; upper mesopleural margin (above subalar fossa) reddish; one specimen from Coinston has two ill-defined reddish spots on mesopleuron along mesopleural suture and single spot on metapleuron dorsally; propodeal dorsum with faint dark bronzy luster. Legs mainly reddish, femora darkened basally, tarsomeres I-IV brownish. Gaster black, apical depressions of terga reddish to various degree, tergum I with reddish lateral spot in some specimens, largely reddish brown in most males; female tergum VI reddish, pygidial setae stout, reddish to dark brown; male terga VI, VII, and part of V reddish.

♀.— Orbital fovea wider than half ocellocular distance. Dorsal length of flagellomere I about 1.1 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X about 1.1 × basal width. Forebasitarsus with 6–8 rake spines. Setae of pygidial plate completely concealing integument. Length 5.0–8.5 mm.

♂.— Lateral corner of clypeal lamella well defined, somewhat prominent (Fig. 162b). Median flagellomeres each with round, shiny, sparsely punctate area on venter. Dorsal length of flagellomere I 0.8 × apical width, of flagellomere II 0.7 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X about 1.3 × basal width. Forebasitarsus with five or six rake spines. Sternum VIII: Fig. 163a. Genitalia: Fig. 163b. Length 4.5–6.5 mm.

Nesting habits.— The nests are mostly excavated in sunny, dry, sandy or loamy river banks. The main gallery is 8–13 cm long; one or two cells are excavated at the end of 2–3 cm long later-

al tunnels from the bottom of the main tunnel. Prey mainly consists of *Tayorimyia iota* (Johnston and Tiegs) (Diptera: Sarcophagidae), but *Calliphora tibialis* Macquard (Diptera: Calliphoridae) was found in a few nests (Matthews and Evans, 1971). Unlike *Sericophorus viridis*, the prey spectrum of *S. relucens* contained a small proportions of females. Several museum specimens were collected as they were preying on flies around cattle or on a carcass, and several females were landing on W. Pulawski's bare forearms and palms at Hamelin Telegraph Station on 8 November 2008, obviously in search of *Musca vetustissima* Walker (Diptera: Muscidae) that were also attracted to the same body parts. Carrying paralyzed *Musca vetustissima* on the sting was observed by McCorquodale (1988) in Warrumbungle National Park, New South Wales. Impaling prey on the sting is known elsewhere only in *Oxybelus*, Crabroninae, although Nielsen, 1933, recorded one case in *Crossocerus elongatulus* (Vander Linden). *Musca vetustissima* was also a prey of a specimen from Wilpena Pound, South Australia (USNM). The number of prey found in three cells were six, seven, and seven, respectively. *Ephutomorpha mackayensis* André (Hymenoptera: Mutillidae) is a probable parasitoid (Matthews and Evans, 1971).

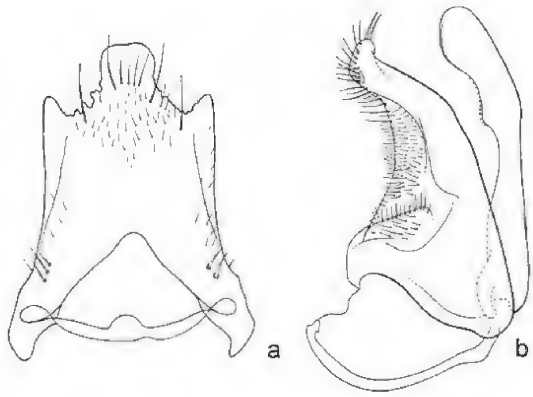

FIGURE 163. *Sericophorus relucens* F. Smith: a – sternum VIII of male; b – male genitalia in lateral view.

GEOGRAPHIC DISTRIBUTION (Fig. 164).— All Australia except Tasmania, New Caledonia, and southwestern Papua New Guinea.

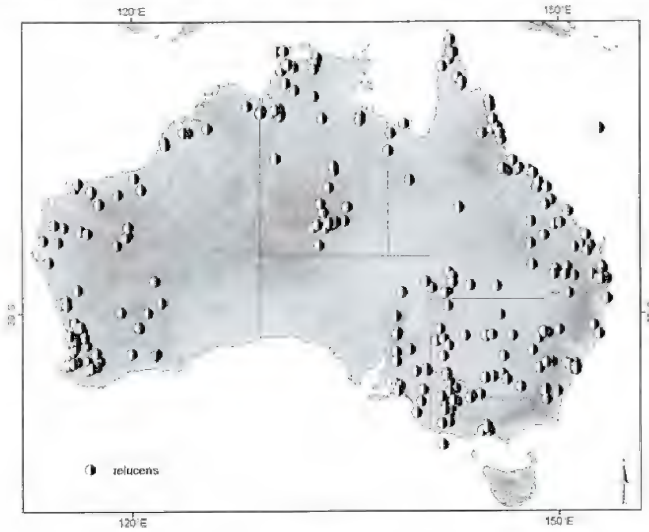

FIGURE 164. Collecting localities of *Sericophorus relucens* in Australia.

RECORDS.— AUSTRALIA (926 ♀, 211 ♂): **Australian Capital Territory**: Black Mountain, blowfly trap, 20 Jan 1931 (ANIC); Pine Island Reserve 10 mi. S Canberra, 24 Dec 1969 and 10 Jan 1970 (MCZ and ANIC). **New South Wales**: Bajada SE Bredbo, Oct 1933 (ANIC); Barnatos Tank 56 mi. W Cobar, 1 Jan 1966 (BMNH); Bathurst, 5 Feb 1931 (RMNH); Beelbangera 5 mi. N Griffith, 16 Dec 1969 (ANIC); Bellbrook, 7 Nov 1990 (AMS); 6 km N Bilpin near Kurrajong, 27 Feb 1979 (AMS); Botany Bay (USNM); Bourke, 25 Oct 1949 (ANIC); Broken Hill, 1 Mar (MCZ); Caldwell, Jan and Feb 1953 and 27 Jan 1958 (NMV); Carrathool, 1920 (ANIC); Clifton Downes, 31 Oct 1949 (ANIC); 30 mi. W Cobar, 24 Nov 1949 (ANIC); Coogee, Dec 1922 (AMS); 10 km S Coonabarabran, 13–17 Jan 1980 (UQIC); Cowra, Jan 1930 (RMNH); Dobroyd Point near North Harbow, Sydney, 14 Dec 1923 (AMS); Fowlers Gap Research Station at 31°05′S 141°42′E, 29 Nov–2 Dec 1981 and 8–9 Dec 1982 (ANIC), Gilgandra, 3 Dec 1986 (AMS); Hawkesbury River, 31 Dec 1930 (NMV); Hay, 13 Jan 1916 (BMNH); Lake Menindee northern shore, 18 and 30 Mar 1953 (CAS); Manga: Kanharoo Park, 7 Nov 1982 and 24 Nov 1986 (ANIC); Milroy, 20 Nov 1914 (NMV);

Milthorpe, 12 Feb 1942 (RMNH); Mongarlowe River 7.5 mi. E Braidwood, 1 Dec 1972 (1 ♀, FSCA); Myalla Tank 49 km NE Broken Hill at 31°50′S 141°57′E, 3 Dec 1981 (ANIC); 25 mi. W Nyngan, 3 Nov 1969 (MCZ); 8 mi. N Peak Hill, 10–12 Dec 1969 (ANIC, MCZ); Port Macquarie, 14 Jan 1931 (NMV); Richmond, 14 Dec 1900, 2 Nov 1902 and 2 Jan 1931 (BMNH); Roseville, 28 Oct 1931 (RMNH); Round Hill Nature Reserve, 26 Dec 1976 (ANIC); Sydney, 5 Mar 1919 (BMNH); Sydney, *Eucalyptus* flowers, 26 Feb 1902 (RMNH); 25 mi. E Tibooburra, 1 Nov 1949; 64 mi. N Tibooburra, 16 Nov 1949 (ANIC); Wagga Wagga, 10 Feb 1931 (RMNH); Wardell, 11 Jan 1933 (NMV); Ward's Creek W Amoxfield, 16 Dec 1966 (ANIC); Warrumbungle National Park, 20 Dec 1987 (UCD) and 17 Dec 1995 (ANIC); Warrumbungle National Park: Camp Pincham, 27 Nov and 11 Dec 1985 (ANIC); 99 km N Wenthworth, 30 Nov 1992 (AMS); 4 mi. E Wilcannia, 1–2 Nov 1969 (MCZ); Woollahra, 10 Feb 1940 (MCZ); Yanco, 8 Nov 1949 (UCD). **Northern Territory**: 33 km S Aileron, 5 Nov 1974, on *Eucalyptus gammophylla* (UQIC); 12–17 mi. E Alice Springs, 22–27 Sept 1972 (USNM); 7 km NW Alice Springs, 8 Nov 1979 (ANIC); 32 km WNW Alice Springs at 23°36′S 133°35′E, 8 Oct 1978 (ANIC); AZRI 8 km S Alice Springs, 4 Nov 1974, on *Eucalyptus gammophylla* and *walenbergia* (UQIC); 40 km N Barrow Creek, 9 Nov 1974, on *Eucalyptus* sp. (UQIC); Bathurst Island: Port Hurd at 11°39′S 130°12′E, 15 May 1998 (NTM); Bitter Springs (SAM); 22 km WSW Borroloola at 16°08′S 136°06′E, 16 Apr 1976 (ANIC); 4 km along Borroloola Road from junction of Stuart Highway, 15 Nov 1974, on *Eucalyptus ?agrillacea* (UQIC); Burnside: Brock Creek, 18 Apr 1929 (ANIC); Caranbirini Waterhole 33 km S Borroloola at 16°16′S 136°05′E, 22 Apr 1976 (ANIC); 20 mi. E Coinston, 18–19 Feb 1966 (BMNH); Cooper Creek 19 km SE Mount Borradaile at 12°06′S 133°04′E, 5–6 June 1973 (ANIC); Curtin Springs Homestead 85 km E Yulara at 25°20′S 131°45′E, 16 Oct 1971; Darwin (holotype of *rufobasalis*, NMV), 136–168 km S Darwin, 11 Jan 1964; Dick Creek 73 km W Timber Creek at 15°50.7′S 129°54.5′E, 12 Apr 2008 (CAS); Dorisvale area, 17 Nov 1984 (NTM); East Alligator Crossing at 12°25′S 132°59′E, 16–18 July 1979 (QMB); Ellery Creek Big Hole in West McDonnell National Park at 23°46.7′S 133°04.4′E, 5 Nov 1979 (ANIC), 6 Mar 2008 (CAS), and 12 Mar 2008 (CAS); Emily Gap 6 mi. SE Alice Springs, 17 Feb 1966 (ANIC); Erldunda at 25°11.9′S 133.12.0′E, 13 Mar 2008 (CAS); near Finniss River at 12°57′S 130°33′E, 8–14 Apr 1998 (NTM); Gregory National Park: at 15°58′17″S 130°29′17″E, 1 June 2001, at 16°00′52″S 130°48′18″E, 18–19 June 2001, at 16°02′26″S 130°27′18″E, 24 May 2001, at 16°02.4′S 130°27.3′E, 6–12 June 2001, at 16°03.7′S 130°27.1′E, 24 May–4 June 2001, at 16°06.6′S 130°25.7′E, 4–12 June 2001, at 16°06.7′S 130°25.4′E, 12–16 June 2001, and at 16°07.55′S 130°26.11′E, 5–12 June (USU); Hermannsburg (BMNH); 14 mi. W Humpty Doo, 14 June 1964 (AMS); Keep River National Park: at 15°45′30″S 129°06′28″E, 26–31 May 2001, 15°54′55″S 129°04′11″E, 31 May–3 June 2001, 6–9 June 2001, and 6 June–6 Sept 2001, 15°57′33″S 129°01′44″E, 31 May–3 June 2001 and 3–8 June, 3–8 June 2001 and 10–20 June 2001 (ANIC, USU), 15°50′00″S 129°06′35″E, 7–9 June 2001, 15°57′55″S 129°01′52″E, 13–20 June 2001 (USU); Keep River National Park: Cockatoo Creek 18.2 mi. S Jarnam Campground, 3–6 Apr 2001 (ANIC); Kelly Well S Tennant Creek, 27 Oct 1962 (CAS); Koongarra 15 km E Mount Cahill, 15 Nov 1972 (ANIC); Leaning Tree Lagoon at 12°43′S 131°25′E, 11 Dec 1997 (NTM); Marrakai Station, 28–31 July 1929 (ANIC); Mac Donald Downs, 30 Oct 1962 (CAS); MacDonnell Ranges, Sept 1907 (SAM); 29 km NW Mataranka at 14°45.5′S 132°51.1′E (CAS); Mc Arthur River 48 km SSW Borroloola at 16°27′S 136°05′E, 14 Apr 1976 (ANIC); Melville Island: Taracumbi Falls at 11°36′S 130°43′E, 6 Oct 1996 (NTM); 16 km NE Mount Cahill at 12°50′S 132°51′E, 16 Nov 1972 (NTM); Ruby Gap Road at 23°29′S 134°58′E, 3 Mar 1997 (NTM); Tennants Creek (SAM, holotype of *relucens ruficornis*); 38.5 km SW Timber Creek on Victoria Highway at 15°42′40″S 130°07′48″E, 6–13 June 2001 (USU); 7 mi. S Ti-Tree Well, 28 Oct 1962 (CAS); Todd River 9 km NE Alice Springs at 23°38′S 133°53′E, 10 Oct 1978 (ANIC); Trephina Gorge near Ghost Gum at 23°32′S 134°23′E, 26 Feb 1997 (NTM); 6.2 km W Trephina Gorge on Rose River Highway at 23°38′S 134°18′E, 1 Mar 1997 (NTM); Virginia near Darwin at 12°33′S 131°02′E, 2 Feb 1998 (NTM); Waterhouse Range 39 km SSW Alice Springs at 23°59′S 133°38′E, 11 Oct 1978 (ANIC); Wigley Waterhole 5 mi. N Alice Springs, 17 Feb 1966 (ANIC); Wilson Creek at 19°08′S 130°09′E, July-Sept 1971 (ANIC). **Queensland**: Almaden in Chillagoe District, Dec 1932 (1 ♀, AMS); 7 km W Almaden, 31 Mar 1981 (ANIC); Amby, 25–26 Oct 1979 (UQIC); Archer River crossing 70 km N Coen, 17–18 July 1975 (QMB); 50 mi. SW Ayr, 9 Oct 1950 (ANIC); Bamaga, 3–15 Jan 1984 (AEI); Biggenden in Bluff Range, 17 Dec 1973 (ANIC); Blackdown Tableland via Dingo, 1–6 Feb 1981 (QMB); Bladensberg, on carcass catching flies, 12 Dec 1930 (ANIC); S Boolboona Range via Mount Perry, 10 Nov 1973 (ANIC); 25 mi. NW Bowen, 1 Oct 1950 (ANIC); 9 mi. S Bowen,

28 Aug 1966 (UQIC); Bribie Island, Nov 1918 (QMB); Brisbane, 8 Jan 1905, 12 Feb 1912, 10 Dec 1912, 17 Oct 1913, 16 Feb 1915, 26 Oct 1915, 9 Nov 1915, Jan 1916, 8 Feb 1916, 15 Feb 1916, 27 Feb 1917, 20 Nov 1917, 19 Feb 1918, 23 Mar 1919, 24 Oct 1922, and no date (ANIC, BISH, QMB); Brisbane: Blunder Creek, 1–7 Nov 1979 and 28 Feb 1980 (UQIC); Buderim Mountain near Mooloolah, Dec 1889 (ANIC); Burdekin River 20 km NE Charters Towers at 20°00.1′S 146°26.3′E, 27 Nov 2006 (CAS); Byfield, 19–22 Dec 1979 (UQIC); Byfield State Forest, 1 Jan 1976 (AMS); Cairns, Feb 1902 (BMNH), no date (neotype of *Sericophorus rufobasalis*, A.M. Lea collector, one of paratypes of this species); Caloundra, 30 Oct 1912, 20 Nov 1916, and Nov 1912 (QMB); Cape York, May 1902 (BMNH); Carnarvon National Park at 25°04′07″S 148°03′26″E (UCD); Chinchilla, Feb 1902 (BMNH); 20 km N Charters Towers on road to Greenvale, 27 Jan 1999 (1 ♀, CAS); Childers, 24 Dec 1988; Clare, 27 Nov 1984 (ANIC); Cockatoo Creek crossing 17 km NW Heathlands at 11°39′S 142°27′E, 15–26 Jan 1992 (ANIC); Coen at 13°57′S 143°12′E, 16 Nov–17 Dec 1993 (ANIC); 28 km W Condamine at Dogwood River, 19 Dec 1987 (AMS); Cooktown, 27 and 28 Jan 1964 (BISH), 10 Feb (BMNH); Cunnamulla, 27–29 Oct 1979 and Nov (MCZ, UQIC); Davies Creek National Park at 17°00′35″S 145°34′54″E, 14 Nov 1971; Deception Bay, 6 Dec 1971; Duaringa (USNM, holotype of *Zoyphium rufipes*); Dulhunty River Crossing, 27–28 Sept 1974 (QMB); 25 mi. E Durham Downs, 11 Nov 1949 (ANIC, lectotype of *relucens nigricornis*); Eidsvold at 25°22′S 151°07′E, 11 Oct 1984 (ANIC); 24 km NE Eidsvold at 25°09′S 151°11′E, 11 Oct 1984 (ANIC); Elalie S Flaggy Rock, 16 Oct 1971 (RMNH); El Arish, Jan 1966 (ANIC); Elimbah, 21 Mar 1966 (UQIC); 5 mls W Emerald, 8 Jan 1973 (ANIC); Esk, 3 Nov 1979 (UQIC); Eungella in Broken Range, 10 Dec 1941 (AMS); Eungella National Park 80 km NW Mackay, 16–19 Oct 1979 (UQIC), Eungella National Park at 21°10.5′S 148°30.3′E, 31 Oct 2006 and 3 Dec 2006 (CAS); Eylo, 2 Mar 1963 (ANIC); Glenmorgan in Gilruth Plains, 4 Nov 1971, on *Eucalyptus* flowers (UQIC), 12 Dec 1963 (ANIC); Hastings Creek 15 km S Biggenden, 6 Nov 1976 (ANIC); Heathlands at 11°45′S 142°35′E, 1–6 Apr and May 1993 (ANIC); 12 km SSE Heathlands at 11°51′S 142°38′E (ANIC); Kamerunga 10 mi. N Cairns, 8–9 Nov 1972 (FSCA); Keelbottom Creek in Harvey Range 60 km NW Townsville, 14 Oct 1981 (RMNH), 33 mi. W Kihee, 12 Oct 1949 (ANIC); Kuranda, 6 Apr 1919 (BMNH), 20 Oct 1949 (BISH), 31 Mar and 18 Apr 1987 (CAS); Kuranda and vicinity, 4–13 Nov 1972 (MCZ); Kuranda: Clohesy Range, 7–9 Nov 1972 (BMNH); Kuranda: Russet Park, 28 Nov 1987 (CAS); Lake Broadwater 30 km SW Dalby, 23 Nov 1985 (QMB); Lake Moondara via Mount Isa, 3 Dec 1974, on *Eucalyptus agrillacea* (UQIC); Lockerbie 10 mi. WSW Somerset, 20–30 Apr 1948 (AMNH); Lockerbie Area in Cape York, 13–27 Apr 1973 (ANIC); Lotus Creek 120 km S Sarina, 14 Oct 1979 (UQIC); Mackay, Oct-Nov 1897, Jan 1891 and 2–3 May 1970 (BMNH, MCZ); Mareeba: Granite Gorge, 19 Feb 1999 (CAS); Moggil Farm W Brisbane, 27 Jan–1 Feb 1961 (BISH); Mornington, on cattle, 9 Oct 1932 (ANIC); 3.5 km SSW Mount Baird at 15°10′S 145°07′E, 3–5 May 1981 (ANIC); 43 miles N Mount Molloy, 10 Dec 1971 (AMS); 3 km NE Mount Webb at 15°03′S 145°09′E, 1–30 Oct 1980 (ANIC); Musselbrook Reserve: Murray Spring at 18°35′S 138°03′E, 13 Apr 1996 (NTM); 35 mi. S Nappamerry, 5 Nov 1949 (ANIC, UCD); Noccundra, 10 Nov 1949 (ANIC); Peach Creek Crossing 25 km NNE Coen, 4–5 July 1976 (ANIC); Redlynch, 1–10 Oct 1938 (BMNH); 1 km N Rounded Hill at 15°17′S 145°13′E, 5–6 Oct 1980 (ANIC); Stradbroke Island, 5 Dec 1913 (QMB); Sunnybank, 1 Dec 1951 (ANIC); Tara, 19 Dec 1960 (UQIC); Thargomindah District, June 1941 (AMS); The Boulders near Babinda, 10 Nov 1962 (CAS); 20 mi. NW Tickalarra, 14 Nov 1949 (ANIC, UCD); Townsville, 2 Jan 1903, 16 Nov 1903, 6 Jan 1969, and no date (ANIC, BMNH, QMB); Watalgan Range 35 mi. NNW Bundaberg, Oct 1970 (ANIC); Weipa Mission, 4 Oct 1957 (ANIC); Westmoreland, around cattle taking fly, 15 May 1936 (ANIC); Westmoreland: The Springs, 30 Sept 1930 (ANIC); Westwood, 28 Oct 1923 (NMV); Williams Dale, 16 Feb 1933 (ANIC); Wonga Beach 11 km NNE Mossman at 16°19.9′S 145°25.3′E (CAS); Yelarbon, Jan 1959 (UQIC). **South Australia**: Adelaide (BMNH, holotype of *relucens*); Christmas W.H. at 27°37′S 136°45′E, 30 Oct 1989 (ANIC); Cooper Crossing, 11 Nov 1965 (CAS); 10 mi. S Jamestown, 15 Mar 1953 (CAS); Keith, 10 Feb 1982 (UCD); Killalpanina 100 mi. E Lake Eyre (BMNH); Markaranka: Morgan, 27 Nov 1962 (SAM); Maslin Beach, 6 Apr 1972 (SAM); Mount Baker, 30 Dec 1963 (SAM); Mount Barker, 27 Dec 1963 (CAS); Mount Lyndhurst 20 km E Farina (AMS); Oraparinna Creek at 31°21′S 138°42′E, 4–10 Nov 1987 (ANIC); Orroroo, 9 Jan 1943 (SAM); Reedy Creek, Dec 1962 (SAM); 19 km N Renmark at 34°00′S 140°47′E, 10 Oct–9 Nov 1995 (ANIC); 32 km N Renmark at 33°53′S 140°44′E, 12 Dec 1995–25 Jan 1996 (ANIC); Sandy Creek, Jan 1940 (SAM); Tooperang near Adelaide, 7 Jan 1966 (BMNH); Wilpena Pound in N Flinders Range, 28 Nov 1951, prey: *Musca vetustissima* (USNM). **Victoria**: Burnley Horticultural Gardens, 16 Feb

1921 (NMV); Daytrap, 1918 (ANIC); 12–26 mi. N Hopetoun, 24 Feb 1970 (MCZ); 5 mi. W Jeparit, 4 Feb 1956 (ANIC); Kerang, 25 Nov 1946 and 10 Mar 1951 (NMV); 5 mi. S Laharum in Grampians, 5 Feb 1956 (ANIC); Lake Hattah, Jan 1933 (BMNH); Lake Meran, 15 Dec 1946 (NMV); Langwarrin (BMNH); Mallee District (NMV); Melbourne, 15 Mar 1930 (NMV); Mildura, 8 Mar 1927 and 17 Jan 1957 (MCZ, NMV); Murtoa, 22 Jan 1936 (SAM); Port Phillip, 6 Sept 1927 (CU); Quantong, Jan 1929 (NMV); 5–15 mi. S. Rainbow, 21–22 Feb 1970 (MCZ); Redcliff, Jan 1924 (VM); Sandringham, 3 Mar 1933, and 10 Mar 1937, 21 Feb 1950 (ANIC; NMV, holotype of *carinatus*); Tattawuppa Hill 6.6 km N Yunta at 32°31′26″S 139°33′32″E, 8 Apr 1982 (AMS); Victoria Valley, 11 Feb 1947 and 26 Feb 1949 (NMV); Wannon, 30 Jan 1948 (NMV); Watchem, 26 Feb 1955 (NMV); Wilkur, Feb and Apr 1955 (NMV); Wyperfiled National Park, 7 Dec 1978 (AMS). **Western Australia**: Arthur River 6 mi. E Darkan, 18–19 Jan 1971 (AMS); Avon Valley (WAMP); 7.5 km SE Banjiwarn Homestead at 27°42′S 121°37′E, 22–28 Feb 1980 (WAMP); 10 mi. SW Beverley, 27 Feb 1953 (ANIC); 4 mi. NNW Bokal, 21 Jan 1953 (ANIC); Bolgart, 1951 (NMV); Bridgetown, 5 Mar 1957 (NMV); 5 km E Broome at 17°58′S 122°17′E, 24 July 1976 (ANIC); near Bullabulling, 2 Nov 1974 (WAMP); Bullsbrook, 17 Dec 1966 (UQIC); Bullsbrook Range N Pierce, 13 Jan 1966 (BMNH); Bunbury, 3 Jan and 26 Jan 1957 (AMS, NMV); 18 mi. S Bunbury, 7 Jan 1957 (AMS); Bushmead, 17 Dec 1966, on *Melaleuca* (UQIC); Busselton, 2 Apr 1954 (ANIC); Capel, 18 Jan 1957 (NMV); 34 mi. NE Cardawan Homestead SSW Mundiwindi, 27 Apr 1963 (ANIC); 2 km N "Cataby" via Dandaragan, 30 Dec 1975, on *Eucalyptus* (UQIC); 10 km W Cobra Station at 24°10.2′S 116°23.0′E, 26 Apr–10 May (CAS); Collie, Jan 1955 and 13 Jan 1957 (NMV); 12 km ENE Comet Vale Siding at 29°57′S 121°07′E, 7–15 Mar 1979 (WAMP); Darling Range, 26 Jan 1957 (NMV); Dedari 40 mi. W Coolgardie, 11–21 Jan 1936 (BMNH); Derby, 23 Feb 1962 (RMNH); E Dongara, 5 Mar 1975 (AMS); 13 km SE Dongara, 30 Dec 1975, on *Eucalyptus* (UQIC); Dumbleyung, 6 Dec 1962 (WAMP); Foot Isdell Range W. Kimberley, 8 Nov 1974 (RMNH); Gascoyne Research Station, Carnavon, 3–7 Oct 1969 (MCZ); Gingin, 14 Apr 1969 (WAMP); 20 km N Gingin at 31°12′S 115°48′E, 1 Jan 1995 (UCD); Glen Forest, 11 Mar 1973 (WAMP); Hamelin Telegraph Station at 26°23.9′S 114°09.9′E, 8 and 10 Nov 2008 (CAS); Hatter Hill 40 km NW Lake King, 29 Dec 1979 (WAMP); Irwin River at Strawberry Station 19 km W Mingenew, 2 Nov 1987 (CAS); Irwin River at Yaragadee, 3 Nov 1987 (CAS); Jandakot, 9 Jan 1977 (WAMP); Katanning, 6 Feb 1973 (UQIC); Kennedy Range National Park at 23°56.8′S 115°10.4′E, 26 Apr–10 May 2003 (USU); Kojonup, 3 Jan 1979 (WAMP); Landsdowne Station via Derby, 8 Sept 1964 (ANIC); 104 km E Marble Bar at 21°19.1′S 120°40.3′E, 2–15 May 2003 (ANIC); Mardie S Fortescue River mouth, 23 Aug 1934 (ANIC); Mardie Station 28 km E Forescue Roadhouse at 21°11.3′S 115°58.5′E, 21–23 May 2003 (USU); Mary River at Kimberley, 23 Nov 1974 (RMNH); Millstream at Crossing Pool , 27 Oct 1970 (ANIC); Millstream at Fortescue River S Roeburne, 22 Feb 1977 (AMS); 24 km S Mingenew, 7 Jan 1976, on *Eucalyptus* sp. (UQIC); 13 km ESE Mooka Homestead at 24°58′S 114°49′E, 9–11 May 1981 (WAMP); Moora, 6 Nov 1979 (UCD); Mount Augustus National Park at 24°21.9′S 116°52.2′E, 25 Apr 2001 (ANIC); 74 km S Newman at 23°56.0′S 119°46.0′E, 6–28 May 2003 (ANIC, USU); 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003 (ANIC); near New Norcia, 6 Mar 1975 (WAMP, ANIC); 70 km S Norseman, 2 Jan 1977 (WAMP); Northam, 23 Jan 1973 and 10 Nov 1979, on *Eucalyptus* sp. (UCD, UQIC); 80 km S Pardoo Roadhouse on Shay Gap Road at 20°28.3′S 120°10.0′E, 7 Jan –14 May 2003 (ANIC); Pearce, 17 Dec 1966, on *Melaleuca* (UQIC); Perth, Jan 1915 and 25 Feb–12 Mar 1936 (BMNH, WAMP); 10 mi. SE Perth, 27 Dec 1966 (UQIC); Pigeon Rocks, 9 Nov 1961 (WAMP); Pinjarra, 9 Apr 1950 (AMS); Preston, 29 Mar 1963 (RMNH); Rottnest Island (WAMP); Salmon Gums (WAMP); Serpentine Falls in Darling Ranges, 20 Jan 1971 (AMS); Subiaco, Mar 1913 (WAMP); Swan River (QMB); Thangoo S Broome, 4 Sept 1934 (ANIC); 30 km ESE Three Rivers Station at 25°13.6′S 118°56.9′E, 24 Apr–7 May (3 ♀, ANIC) and 21–23 May 2003 (ANIC); 60 km N Tom Price on Hamersley Iron road at 22°18.8′S 117°40.5′E, 20 Apr–4 May 2003 (USU); Tunney (WAMP); Wandagee (WAMP); Wellington Mills (WAMP); Wickepin (WAMP); Woodstock Station at 21°37′00″S 119°01′24″E, 27 Sept 1988 (WAMP); Wurarga: Marloo Station, 2 Mar 1935 (ZMHU), Wyndham, 3 Dec 1929 and 26 Oct 1953 (ANIC, WAMP); Yanchep 32 mi. N Perth, 1–7 Jan 1963 (BMNH); Yericoin, 10 Oct 1961 (BMNH); Yundamindera Homestead at 29°15′S 122°06′E, 16 Mar 1979 (WAMP); no specific locality: 2 ♀ (MHNG).

NEW CALEDONIA: Mt. Koghi 17 km NE Nouméa, 30 Sept 1992 (1 ♀, 1 ♂, INHS); SW face of Ni Valley, 2 Nov 1992 (1 ♀, UCD).

PAPUA NEW GUINEA: **Western Province**: Maderi Plantation at 8°27′S 143°04′E (ANIC).

NEW ZEALAND: single ♀ with a pink, circular label and no specific locality or collector's name (MHNG); possibly mislabeled.

Sericophorus rhamphigaster Menke

Figures 13, 165–167.

Sericophorus rhamphigaster Menke, 1989:459, ♀. Holotype: ♀, Papua New Guinea: Western Highlands: Baiyer River (AEI); paratypes examined.

Recognition.— *Sericophorus rhamphigaster* can be instantly recognized by the presence of a hook-like process on sternum I (Figs 165a, 166b), and by its middle clypeal section that it is raised above the labrum. It is also unique in having the distance between the hindocelli equal to the hindocellar width. Subsidiary recognition features are: clypeal lamella without lateral teeth (Fig. 165b, d), double-edged laterally in ventral view (Fig. 165c), forecoxa yellow, basolateral carina of tergum I ending behind the anterior margin of the spiracle, and female eye with enlarged facets near the middle of the inner orbits.

Description.— Frontal punctures minute, less than one diameter apart; frontal line shiny, not extending into frons upper half. Ocellocular distance equal to 0.7 × hindocellar width; distance between hindocelli equal to hindocellar width. Clypeal middle section markedly convex, raised above labrum, lamella without lateral teeth, double-edged laterally in oblique ventral view (Fig. 165c). Labrum slightly convex. Propleuron expanded posterolaterally, expansion oriented anterad (Fig. 165e). Scutal punctures averaging about one diameter apart; scutal flange ending gradually. Mesopleural punctures minute, about one diameter apart; episternal sulcus only minimally foveolate. Propodeal dorsum punctate, with median impression that contains longitudinal carina, delimited by shallow, inconspicuous impression posterolaterally; side minutely, sparsely punctate (except unsculptured anteriorly); posterior surface minutely punctate (except for median sulcus). Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell truncate anteriorly. Basolateral carina of tergum I long, ending behind anterior margin of spiracle (Fig. 166a); spiracle elongate, slit-like; punctures minute, several diameters apart near center of horizontal area; apical depression impunctate. Sternum I with median, conspicuous, hook-like projection that overhangs base of sternum II (Fig. 165a, 166b).

Setae light golden on frons and clypeus, obscuring integument on lower frons and clypeus laterally; appressed on upper frons, postocellar area, and scutum; nearly appressed, oriented anterad on propodeal dorsum.

Head, thorax, and propodeum black except the following are yellow: middle clypeal section, labrum, scape, basal half of mandible (distal half dark brown), pronotal collar and lobe, scutellum and metanotum (only mesally in specimens from Buso); lateral clypeal section reddish brown; female flagellum brown dorsally, yellowish brown ventrally (flagellomere X all yellowish brown in some specimens); male flagellum nearly all dark brown. Forecoxal venter yellow; femora either yellow (reddish brown dorsally) or all reddish brown except forefemur yellow to various extent; tibiae and tarsi either yellow or reddish brown, arolia contrastingly black. Gastral segments I and II and basal half or tergum III reddish brown in most specimens (remainder black), but only segment I reddish brown in one female from Buso.

♀.— Eye facets enlarged near middle of inner orbits. Orbital fovea matt, wider than half ocellocular distance. Dorsal length of flagellomeres I and II about 1.2 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X about 2.5–2.8 × basal width; flagellomere III longer than either II or IV. Forebasitarsus with six to eight rake spines. Setae of pygidial plate not concealing integument. Length 7.5–11.0 mm.

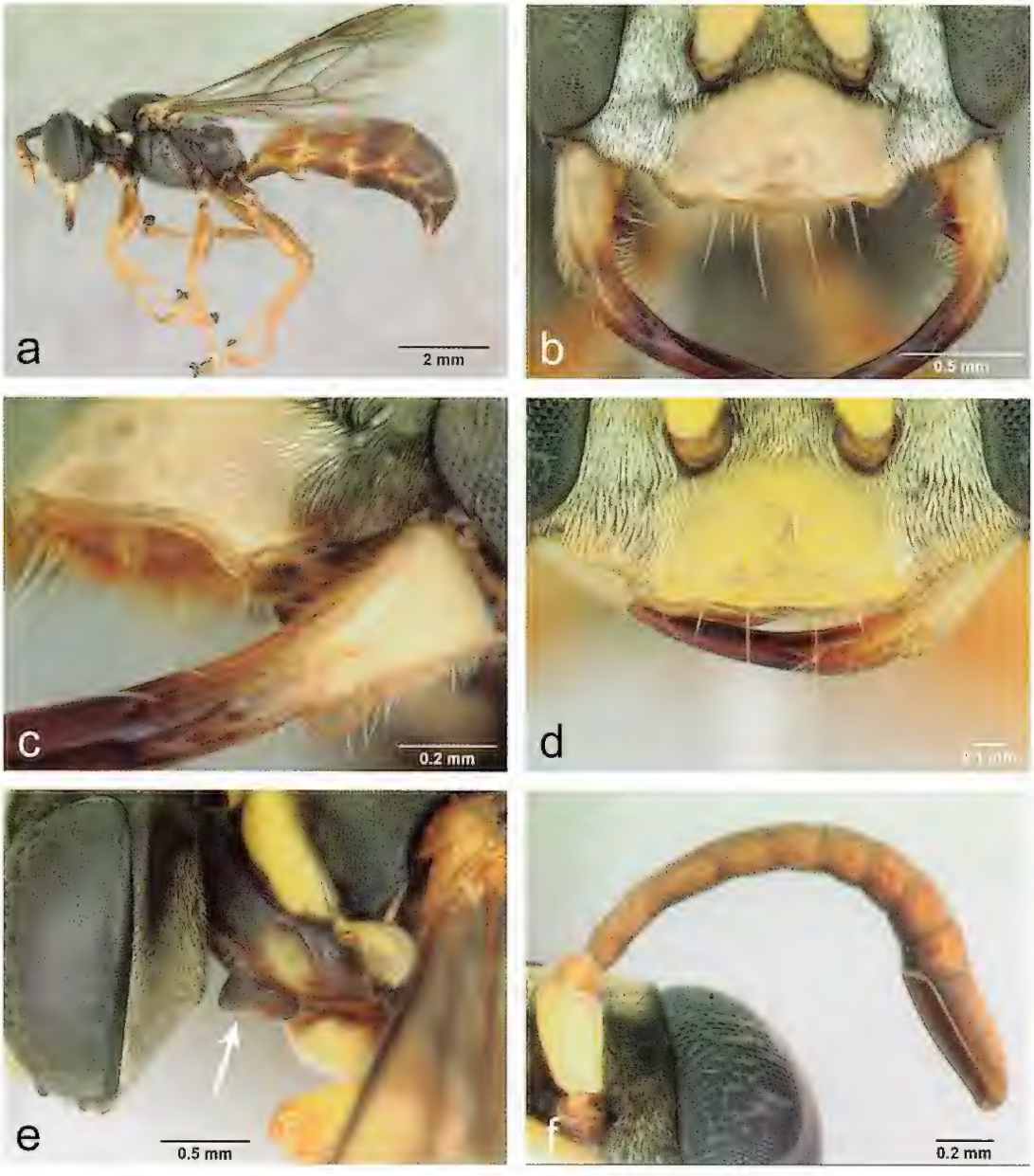

FIGURE 165. *Sericophorus rhamphigaster* Menke: a – female body in lateral view; b – female clypeus in frontal view; c – female clypeus in oblique lateral view; d – male clypeus in frontal view; e – posterior part of female head and anteroventral part of thorax (arrow indicates posterolateral propleural expansion); f – male antenna.

♂.— Flagellomere II concave ventrally, IV concave basoventrally, convex medioventrally and apicoventrally, V and VI slightly convex ventrally; dorsal length of flagellomere I about 1.0 × apical width, of flagellomere II 1.2 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X about 2.4 × basal width (Fig. 165f). Forebasitarsus with six rake spines. Sternum VIII: Fig. 167a. Genitalia: Fig. 167b. Length 7.0 mm.

COLOR VARIATION.— In specimens from Bulolo, the body maculae are intense yellow, cover-

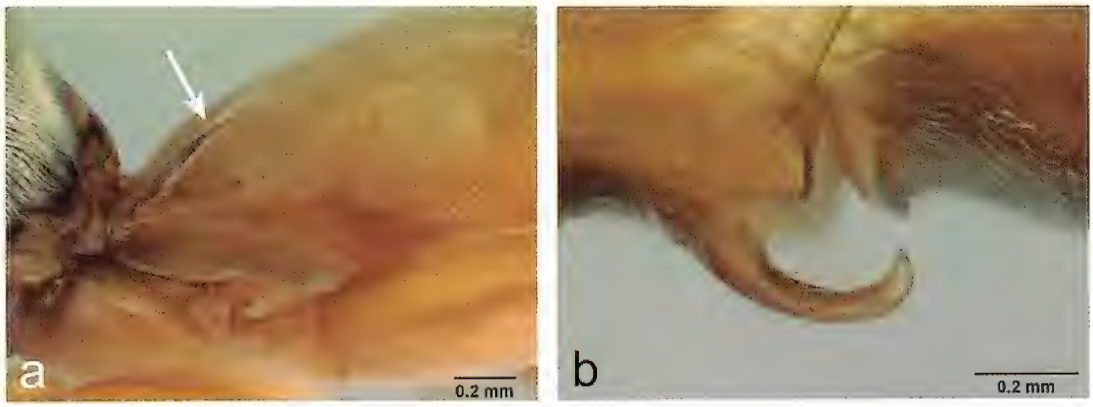

FIGURE 166. *Sericophorus rhamphigaster* Menke: a – anterior portion of female tergum I in oblique lateral view (arrow indicates basolateral carina); b – posterior part of sternum I and basal part of sternum II in lateral view.

ing the entire scutellum and metanotum, whereas in those from Buso they are pale yellow, covering only the middle sections of the scutellum and metanotum.

GEOGRAPHIC DISTRIBUTION (Fig. 13).— Papua New Guinea.

RECORDS.— PAPUA NEW GUINEA: Morobe: Bulolo, 25 Feb 1981 (1 ♂, BMNH; 1 ♂, CAS) and 10 Apr 1981 (2 ♀, BMNH); Buso, Oct 1979 (2 ♀, BMNH). **Western Highlands**: Baiyer River, 25 Jan–6 Feb 1979 (9 ♀, AEI; 2 ♀, CAS; paratypes of *rhamphigaster*).

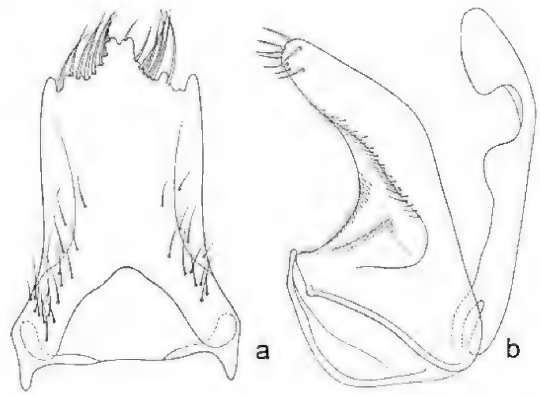

FIGURE 167. *Sericophorus rhamphigaster* Menke: a – sternum VIII of male; b – male genitalia in lateral view.

Sericophorus rhinoceros Pulawski

Figures 156, 168.

Sericophorus rhinoceros Pulawski, 1989:319, ♀. Holotype: ♀, New Caledonia: Mt. Koghi (BISHOP), reexamined in 2009.— Ohl, 2009:30 (locality records), 31 (photographs).

RECOGNITION.— The female of *rhinoceros* (the male is unknown) is immediately recognized by a conspicuous, horn-like clypeal prominence (Fig. 168a, b) and by the emarginate clypeus free margin, with the lamella perpendicular to the remaining surface (Fig. 168c). Subsidiary recognition features are: posteroventral mandibular tooth rounded, episternal sulcus not foveolate, tergum I with a pair of conical projections (Fig. 168d, e), and sternum I with a prominent bulge (Fig. 168e).

DESCRIPTION.— Frontal punctures minute, most less than one diameter apart. Frontal line extending to about frontal midheight. Ocellocular distance equal to 1.2 × hindocellar width. Interocellar area convex adjacent to hindocellus, concave mesally. Posteroventral mandibular tooth rounded. Propleuron prominent posterolaterally, prominence oriented anterad. Scutal punctures near center averaging about two diameters apart; scutal flange gradually narrowing toward apex. Mesopleural punctures near center averaging about two diameters apart; episternal sulcus not foveolate. Propodeal dorsum finely punctate, crenulate along foremargin, with shallow, ill-defined

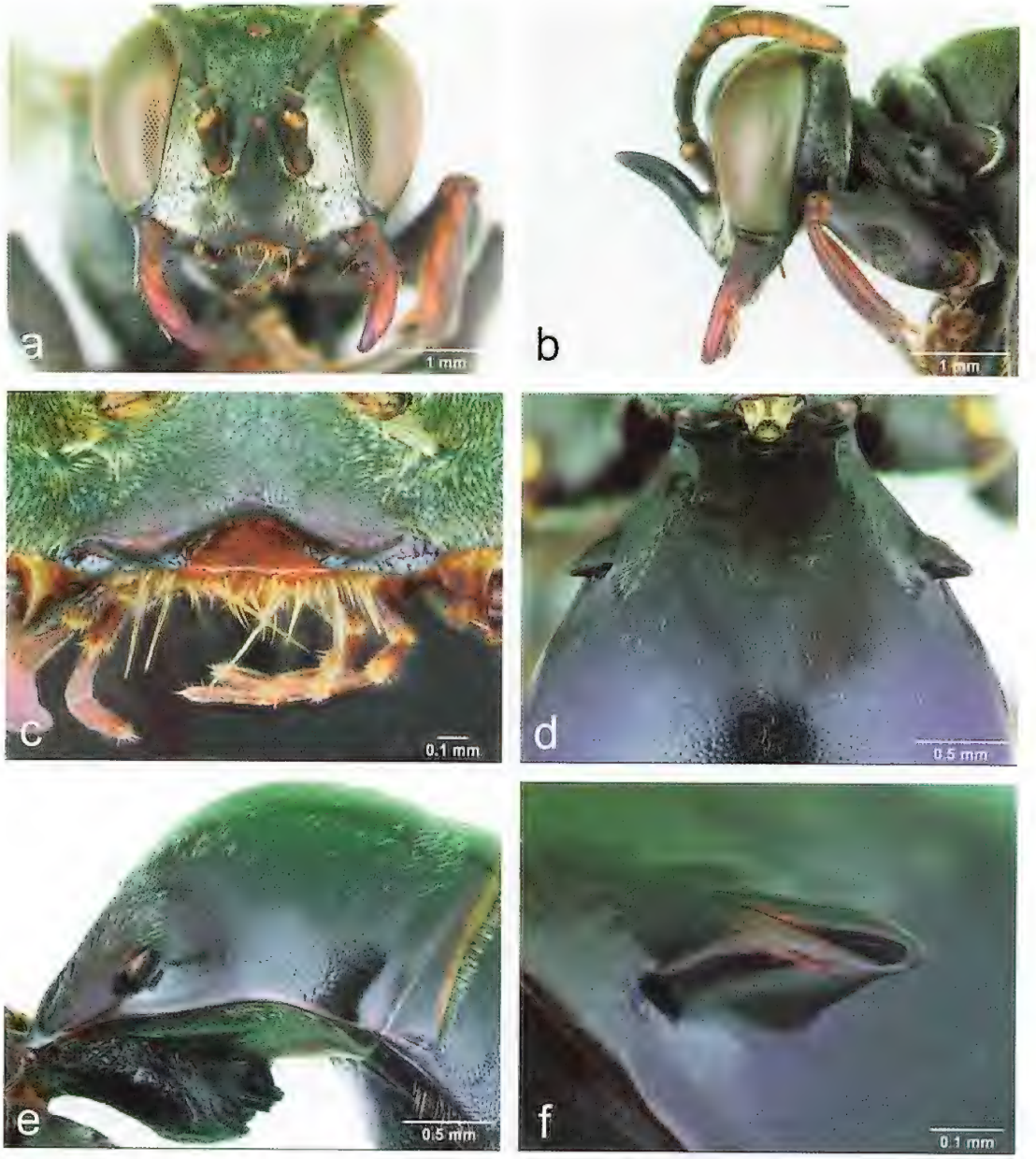

FIGURE 168. *Sericophorus rhinoceros* Pulawski: a – female head in frontal view; b – female head in lateral view; c – female clypeus in ventral oblique view; d – female tergum I in dorsal view; e – gastral segment I of female in lateral view; f – spiracular prominence of female tergum I in lateral oblique view.

median sulcus, without median carina; side conspicuously microsculptured and with minute, scattered punctures, not separated from posterior surface by longitudinal carina or oblique carinae; posterior surface finely punctate except for median sulcus area. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular (holotype) or narrowly opened. Tergum I concave anteriorly, with basolateral carina that effaces behind spiracle; also with conspicuous, conical prominence between carina and laterotergite on which spiracle is located (Fig. 168d); spiracle

slit-like (Fig. 168f); punctures of horizontal area several diameters apart; apical depression impunctate in posterior half; apical depression of tergum II impunctate near apex. Sternum I with prominent bulge, bulge broad in lateral view, concave ventrally (Fig. 168e).

Setae of lateral lower frons and lateral clypeus silvery, obscuring integument; appressed on upper frons, postocellar area, and scutum; markedly inclined anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except mandible reddish brown medially and flagellomeres IV-X or VI-X yellowish ventrally. Legs black except foretibia reddish brown (dark brown on outer side). Wings infumate except nearly hyaline basally

♀.— Orbital fovea ill defined, about as wide as half ocellocular distance. Middle clypeal section with dorsally oriented median horn-like process that is longer than scape (Fig. 168a, b); free margin emarginate mesally; lamella perpendicular to remaining clypeus (Fig. 168c), thus invisible in frontal view, without lateral teeth. Dorsal length of flagellomere I 1.4 × apical width, of flagellomere II 1.3 × apical width; greatest length of flagellomere IX 1.0 × apical width; greatest length of flagellomere X 1.92.2 × basal width. Forebasitarsus with seven rake spines. Setae of pygidial plate concealing integument. Length about 13.0 mm.

♂.— Unknown.

Geographic distribution (Fig. 156).— New Caledonia.

Records.— NEW CALEDONIA: Mount Koghi, Feb 1973 (1 ♀, BISH, holotype of *Sericophorus rhinoceros*); Mount Mandjélia 6 km WSW Puébo at 20°24′09″S 164°30′54″E, 17 Jan 1996 (1 ♀, INHS); Pic du Pin at 22°14′S 166°50′E, 23 Dec 2004–12 Jan 2005 (1 ♀, CAS; 1 ♀, OHL) and 25 Nov–23 Dec 2004 (1 ♀, QMB); Forêt Nord at 22°19′S 166°55′E, 22 Dec 2004–9 Jan 2005 (1 ♀, QMB).

***Sericophorus riparius* Pulawski, sp. nov.**

Figures 169, 170.

Name derivation.— *Riparius*, Latin masculine adjective meaning *of shore* or *belonging to shore*.

Recognition.— *Sericophorus riparius* is a small species (length 10.5 mm), without major specializations: the thorax, propodeum, hindfemur, and gaster are all black (except for a pale yellow pronotal lobe), without metallic luster, the setae are appressed on the head and thorax, the frons is densely punctate, the clypeus is yellow, not emarginate and without elevation, the pronotal collar is not emarginate and reaches the level of the scutum, the axilla is not expanded laterally, the propodeal dorsum is finely punctate and has no sublateral carina, three submarginal cells are present, the forecoxa is largely black, the hindtibia is not swollen, the basolateral carina of tergum I ends well before the anterior margin of the spiracle, tergum I has an impunctate apical depression, sternum I has no projection, and female tergum VI is densely setose. *Sericophorus chrysophorus*, *laevigatus*, the Malaccan *ambonensis*, and the New Guinean *subalaris* are similar, but in *riparius* the clypeus is yellow rather than black (see these species for other differences). Also similar are *glossatus*, in which the glossa is about three times as long as the scape (shorter than scape in *riparius*), and *laticeps*, in which the free margin of the middle clypeal section is double-edged (simple in *riparius*) and the head is unusually wide (width about 1.5 × length, rather than 1.2 × in *riparius*, length measured from midpoint of clypeal free margin to top of vertex). Unlike *trichocephalus*, the clypeus of *riparius* is yellow (rather than black), the inner eye orbits are slightly convergent dorsad (Fig. 169a) rather than slightly diverging, and in the female the setae of the lower frons are not contrasting with those of the upper frons.

Description (based on holotype only).— Head transverse (Fig. 169a), width about 1.2 × height (height measured from midpoint of clypeal free margin to top of vertex). Frontal punctures nearly contiguous. Frontal line well defined, but present only well below frontal midheight. Anten-

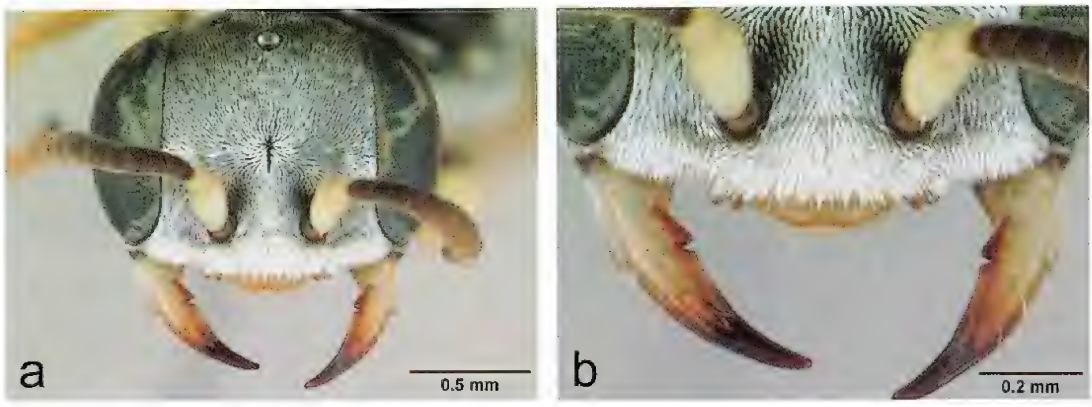

FIGURE 169. *Sericophorus riparius* Pulawski, sp. nov.: a – female head in frontal view; b – female clypeus in frontal

nal socket separated from clypeal free margin by less than two socket widths. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.9 × hindocellar width. Propleuron somewhat prominent posterolaterally (prominence oriented posterad). Scutal punctures about one diameter apart; scutal flange ending abruptly. Mesopleural punctures microscopic, evanescent, about 2–3 diameters apart beneath scrobe. Propodeal dorsum with basal, crenulate sulcus, with median carina on narrow, glabrous area, and with a few cross ridges emerging from carina; side finely microsculptured; posterior surface punctate except for median sulcus. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell narrowly open anteriorly, practically triangular. Tergum I: punctures of horizontal area minute, several diameters apart; apical depressions of terga I and II impunctate.

Setae of lower frons and clypeus silvery, fully obscuring integument; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum, completely concealing integument from many angles.

Head, thorax, propodeum, and gaster black except the following: clypeus, scape, pedicel, and pronotal lobe pale yellow; flagellum black dorsally, brown ventrally; mandible yellow basally, reddish mesally, dark brown apically. Forecoxa pale yellow apically; trochanters pale yellow (hindtrochanter somewhat obscured dorsally); fore- and midfemora pale yellow, black dorsally (black extending slightly beyond femoral midlength), hindfemur black except pale yellow apically, tibiae pale yellow dorsally, light brown ventrally; tarsi light brown.

♀.— Orbital fovea absent. Clypeus closely punctate except lamella impunctate (Fig. 169b). Dorsal length of flagellomeres I and II 0.8 × apical width; greatest length of flagellomere IX 1.0 ×

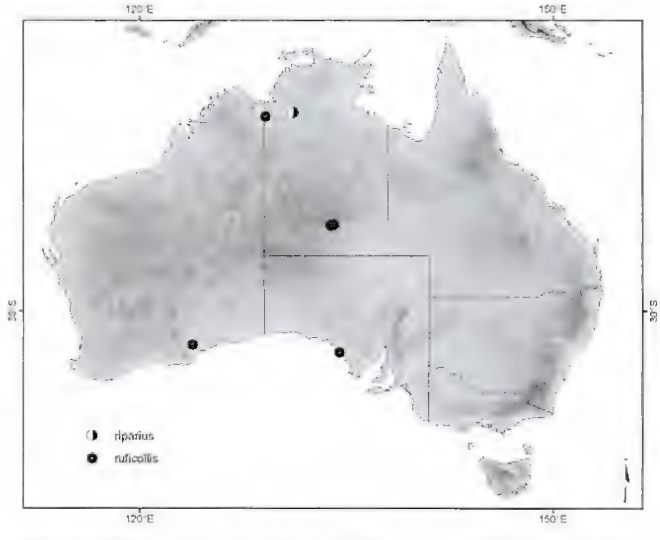

FIGURE 170. Collecting localities of *Sericophorus riparius* and *ruficollis*.

apical width; greatest length of flagellomere X 1.5 × basal width. Right forebasitarsus with seven, left forebasitarsus with six rake spines. Setae of pygidial plate concealing integument. Length 10.9 mm.

♂.— Unknown.

HABITAT.— The only specimen of *riparius* was collected on a flat, sunny, sandy area bordered by trees next to the shore of Victoria River, but several dozen meters above the river waters, apparently well above the flooding levels.

GEOGRAPHIC DISTRIBUTION (Fig. 170).— Known from one locality in Northern Territory.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **Northern Territory**: Gregory National Park near Victoria River Roadhouse at 15°37.8′S 131°08.7′E, 14 Apr 2008, W.J. Pulawski and G.A. Williams (ANIC).

***Sericophorus ruficollis* Lomholdt, sp. nov.**

Figures 170–172.

NAME DERIVATION.— *Ruficollis*, a Latin adjective derived from *rufus*, red, and *collum*, neck; with reference to the reddish brown pronotum.

RECOGNITION.— *Sericophorus ruficollis* has the upper frons and postocellar area with erect setae, anterior declivity of tergum I concave, frons black and terga contrastingly metallic blue, scutum and mesopleuron conspicuously microsculptured between punctures, middle sulcus of the propodeal dorsum almost parallel-sided (not triangular), and the propodeal side separated from the posterior surface by a series of oblique ridges. In the female, at least the pronotal collar is reddish brown. In the male, flagellomeres II-VI are cylindrical (not convex or expanded ventrally), the lateral angle of the clypeal middle lobe is obtuse (Fig. 171b), and the metallic gaster contrasts with the black scutum and scutellum (at least slightly so).

DESCRIPTION.— Frons swollen near center; frontal punctures well defined, about 1–2 diameters apart (more than that near center); interspaces conspicuously microareolate, dull; frontal line extending from frontal midheight to midocellus (evanescent in upper part). Ventral portion of middle clypeal section slightly concave. Interocellar area convex adjacent to hindocellus, concave mesally. Ocellocular distance equal to 1.2 × hindocellar width in female and to 1.1× in male. Scutal punctures on disk up to about 2–3 diameters apart; interspaces conspicuously microsculptured; scutal flange ending gradually. Mesopleural punctures averaging more than one diameter apart near center. Scutellum markedly convex mesally, punctures only insignificantly sparser near center that on adjacent areas. Propodeal dorsum finely punctate; adjacent to foremargin with deep, crenulate sulcus that extends mesally into well-defined, glabrous, longitudinal sulcus; longitudinal sulcus with several transverse carinae, also with longitudinal carina in some specimens; side microsculptured, punctate, and finely ridged, finely microareolate anteriorly, separated from posterior surface by series of conspicuous, oblique ridges (some ridges connected by longitudinal carina in some specimens); posterior surface punctate on each side of median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell markedly narrowed anteriorly, triangular in one specimen. Horizontal area of tergum I with punctures that are about one diameter apart; anterior declivity markedly concave; apical depressions of terga punctate throughout.

Setae silvery, partly obscuring integument on lower frons along orbit and on clypeus laterally; erect on upper frons and postocellar area, about as long as 0.6 × midocellar width on interocellar area; suberect on scutum; suberect, oriented anterad on propodeal dorsum.

Head, thorax, and propodeum black (thorax all metallic green in specimen from Keep River National Park) except the following: clypeal lamella reddish brown, also ventral portion of middle clypeal section in female; mandible yellowish red basally, dark brown apically; antenna yellowish

brown, with apical flagellomere in female, three apical flagellomeres in male, darkened dorsally; pronotal collar dark reddish in female (nearly all pronotum reddish in holotype and specimen from Alice Springs area); pronotal lobe dark reddish in both sexes, nearly black in female from Alice Springs area; propodeum with faint bluish tinge. Legs light yellowish brown, coxae black. Gaster with metallic greenish or bluish luster except pygidial plate in female reddish brown (luster faint in some males).

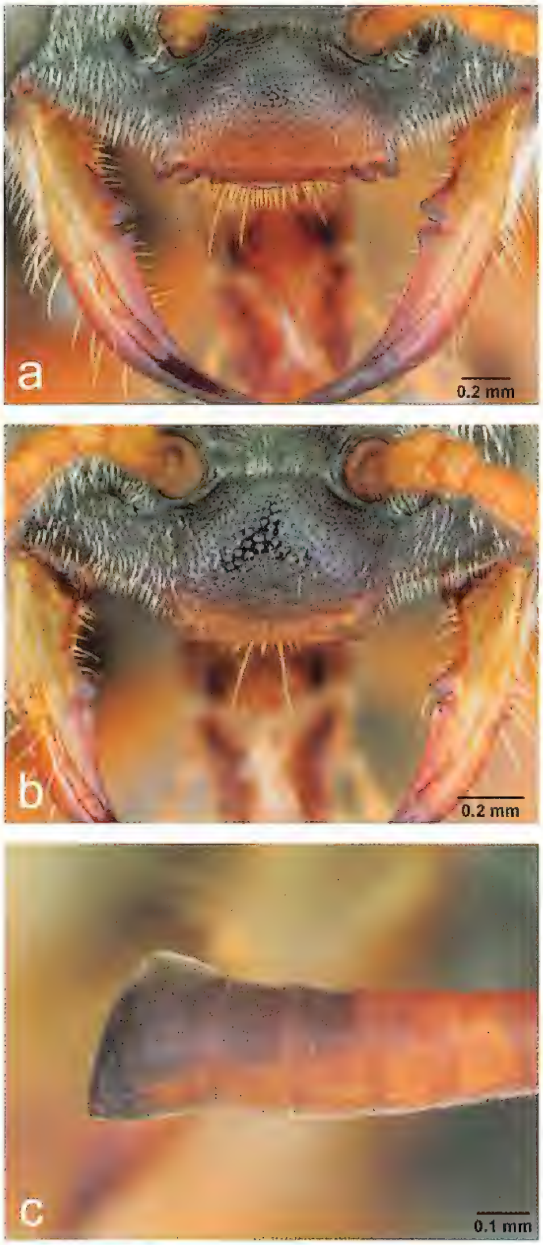

FIGURE 171. *Sericophorus ruficollis* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view; c – apical flagellomeres of male.

♀.— Orbital fovea ill defined. Clypeal lamella straight; lateral teeth prominent (Fig. 171a). Dorsal length of flagellomere I about 1.2 × apical width, of flagellomere II 1.1 × apical width; greatest length of flagellomere IX equal to 0.6 × apical width, of flagellomere X 1.0 × basal width. Forebasitarsus with 7–9 rake spines. Setae of pygidial plate largely concealing integument. Length 8.0–9.0 mm.

♂.— Clypeal lamella straight; lateral tooth prominent. Flagellum broadening toward apex (Fig. 171c); dorsal length of flagellomere I about 0.8 × apical width, of flagellomere II 0.9× apical width; greatest length of flagellomere IX 0.5 × apical width; flagellomere X folded apically in both males examined. Forebasitarsus with five rake spines. Sternum VIII emarginate apically (Fig. 172a). Genitalia: Fig. 172b. Length 6.0–7.0 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 170).— Northern Territory, South Australia, Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: South Australia**: Mt. Hall in Eyre Peninsula, 6 Dec 1968, N. McFarland (SAM). PARATYPES: **AUSTRALIA: Northern Territory**: 12–17 mi. E Alice Springs, 22–27 Sept 1972, H.E. Evans (1 ♀, ANIC);

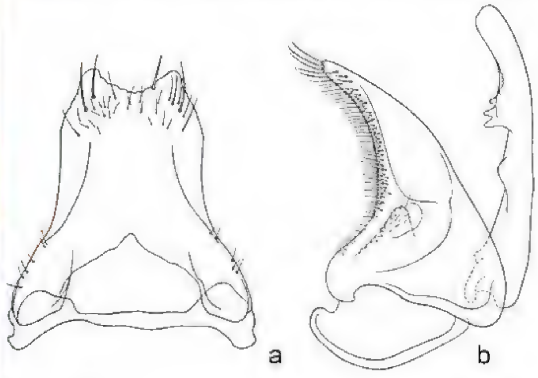

FIGURE 172. *Sericophorus ruficollis* Lomholdt, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view.

Roe Creek 12 mi. SW Alice Springs, 23–28 Sept 1972, H.E. Evans (1 ♂, MCZ); Keep River National Park at 15°55′22″S 129°05′25″E, 25 June 2001, F.D. Parker, M.E. Irwin, and C. Lambkin (1 ♀, USU). **South Australia**: same data as holotype (1 ♀, 1 ♂, SAM). **Western Australia**: Balladonia, 1935, A.E. Baesjou (1 ♀, SAM).

***Sericophorus rufithorax* Lomholdt, sp. nov.**
Figures 173–175.

NAME DERIVATION.–*Rufus*, Latin for red, and *thorax*, Greek for breast.

RECOGNITION.— *Sericophorus rufithorax* can be instantly recognized by its coloration: the scutum, scutellum and metanotum are reddish brown (scutellum may be yellowish brown), whereas the mesopleuron largely, mesothoracic venter, and propodeum are black (Fig. 173a). Additionally, the clypeus, pronotal collar, and legs are yellow, the gaster is reddish brown at least basally, and the setae on the frons are golden, totally concealing the integument up to the hindocellus. Also, the clypeal lamella has only one lateral tooth on each side (Fig. 173b, c), flagellomere II is markedly shorter than wide, and the forebasitarsus rake spines are unusually long (length of apical spine about 2.0 × basitarsus apical width in female and 1.2–1.6 × in male).

DESCRIPTION.— Head transverse, width equal 1.26 × height in both sexes (measured from the clypeal free margin to top of vertex). Frontal punctures minute, contiguous; frontal line ill defined. Antennal socket separated from clypeal free margin by socket width. Ocellocular distance about 0.8 × hindocellar width. Clypeal lamella arcuate, with only one lateral tooth on each side (Fig.173a, b). Most scutal punctures less than one diameter apart, but about two diameters apart near center in holotype female; interspaces with evanescent microsculpture, shiny; scutal flange gradually narrowing posterad. Mesopleural punctures about one diameter apart near center. Propodeal dorsum with short, longitudinal carinae emerging from anterior margin, with median carina in shallow, glabrous impression that is crossed by short, transverse carinae; remaining surface minutely, somewhat irregularly ridged; side punctate or ridged except anteriorly, separated

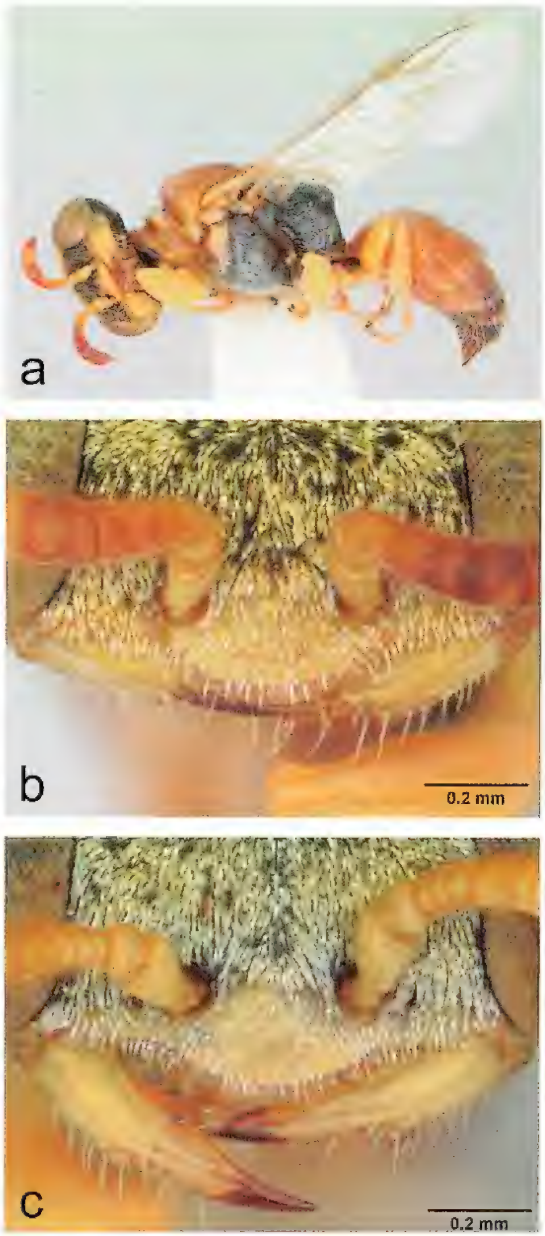

FIGURE 173. *Sericophorus rufithorax* Lomholdt, sp. nov.: a – female body in lateral view; b – female clypeus in frontal view; c – male clypeus in frontal view.

from posterior surface by series of transverse ridges; posterior surface ridged (except for median sulcus). Forewing vein M interstitial with cu-a or diverging from M+Cu distally to cu-a; second submarginal cell narrowly open anteriorly. Basolateral carina of tergum I ending well before anterior margin of spiracle in most specimens, but ending at the level of anterior margin of spiracle in specimen from Areyonga, Northern Territory; punctures of tergum I minute, several diameters apart on horizontal area; apical depressions of terga I-III impunctate in posterior half or so.

Setae golden, totally concealing integument on frons (up to hindocellus) and lateral clypeal sections; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

Head black except the following are pale yellow: clypeus, gena adjacent to mandibular base, scape, pedicel, mandible (mandibular apex brown), and a few basal flagellomeres in specimens from New South Wales; remaining flagellomeres yellowish brown. Pronotum reddish brown in female, partly black in male, pronotal lobe and collar pale yellow in both sexes. Scutum, scutellum, and metanotum reddish brown (scutum pale yellow anterolaterally); mesopleuron largely black, but preepisternal area dorsally and subalar area pale yellow in specimens from New South Wales, reddish yellow in that from Northern Territory; mesothoracic venter and propodeum black. All coxae pale yellow. Forefemur and foretibia pale yellow; mid- and hindfemora and tibiae pale yellow, partly brown to a lesser or greater degree; tarsi pale yellow or partly yellowish brown. Gaster all reddish brown in females from New South Wales, only terga I-III reddish brown in female from Northern Territory (remainder dark brown); in male, tergum I reddish brown and remainder black.

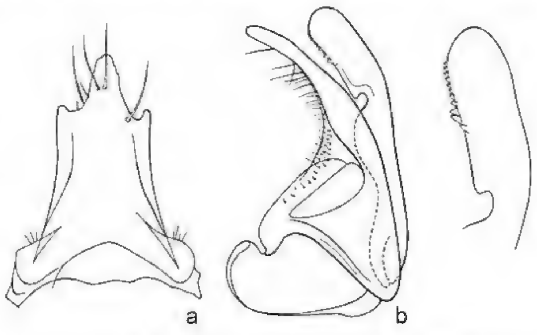

FIGURE 174. *Sericophorus rufithorax* Lomholdt, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view, with outline of penis valve.

♀.— Orbital fovea long, narrow, its width less than half ocellocular distance. Dorsal length of flagellomere I about 0.9 × apical width, that of flagellomere II 0.6 × apical width; greatest length of flagellomere IX equal to 0.8 × apical width, of flagellomere X 1.4 × basal width. Fore-basitarsus with five or six rake spines, spines elongate (longest spines about twice basitarsus width). Setae of pygidial plate not concealing integument. Length 4.6–5.0 mm.

♂.— Dorsal length of flagellomere I about 0.8 × apical width, that of flagellomere II 0.6 × apical width; greatest length of flagellomere IX equal to 0.8 × apical width, of flagellomere X 1.0 × basal width. Forebasitarsus

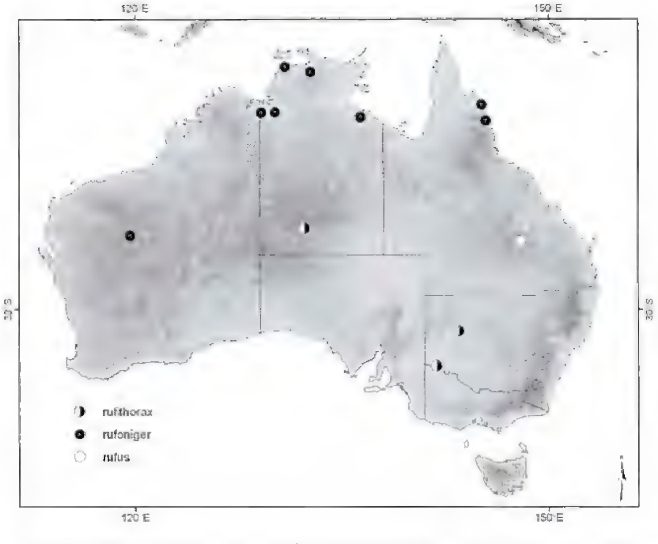

FIGURE 175. Collecting localities of *Sericophorus rufithorax*, *rufoniger*, and *rufus*.

with five or six rake spines, spines elongate (longest spines 1.2–1.6 × basitarsus width). Sternum VIII: Fig. 174a. Genitalia: Fig. 174b. Length 3.8–4.2 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 175).— New South Wales, Northern Territory.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **New South Wales**: 4 mi. E Wilcannia, 20 Nov 1969, H.E. Evans (MCZ). PARATYPES: **AUSTRALIA**: **New South Wales**: same data as holotype, but 19 Nov 1969 (1 ♀, MCZ); 3 mi. W Wentworth, 27 Nov 1969, H.E. Evans (2 ♂, MCZ). **Northern Territory**: Areyonga circa 180 km WSW Alice Springs, 8 Dec, no year or collector (1 ♀, AEI).

Sericophorus rufoniger (Turner)

Figures 175–177.

Zyphium rufonigrum Turner, 1908:494, ♂. Lectotype: ♂, Australia: Northern Territory: Darwin (BMNH), **present designation by O. Lomholdt**, examined by O. Lomholdt and W. Pulawski.— Turner, 1914:356 (in revision of Australian *Zyphium*).— **As *Sericophorus rufoniger***: Bohart and Menke, 1976:303 (new combination, listed, as *rufonigrus*), 628 (*rufoniger* is the correct spelling); Cardale, 1985:253 (in catalog of Australian Sphecidae).

RECOGNITION.— Like *mimus*, *rufoniger* has the pronotum, scutum, and propodeum reddish brown, whereas the scutellum, metanotum, mesothoracic venter, and gaster are contrastingly black (Fig. 176c). Also, the pronotum of these two species is longer than in other *Sericophorus* (Fig. 176d). Unlike *mimus*, the clypeus of *rufoniger* is yellow, the mesopleuron is reddish brown (all or largely so), the forecoxa is pale yellow or reddish brown, the fore- and midfemora have a pale

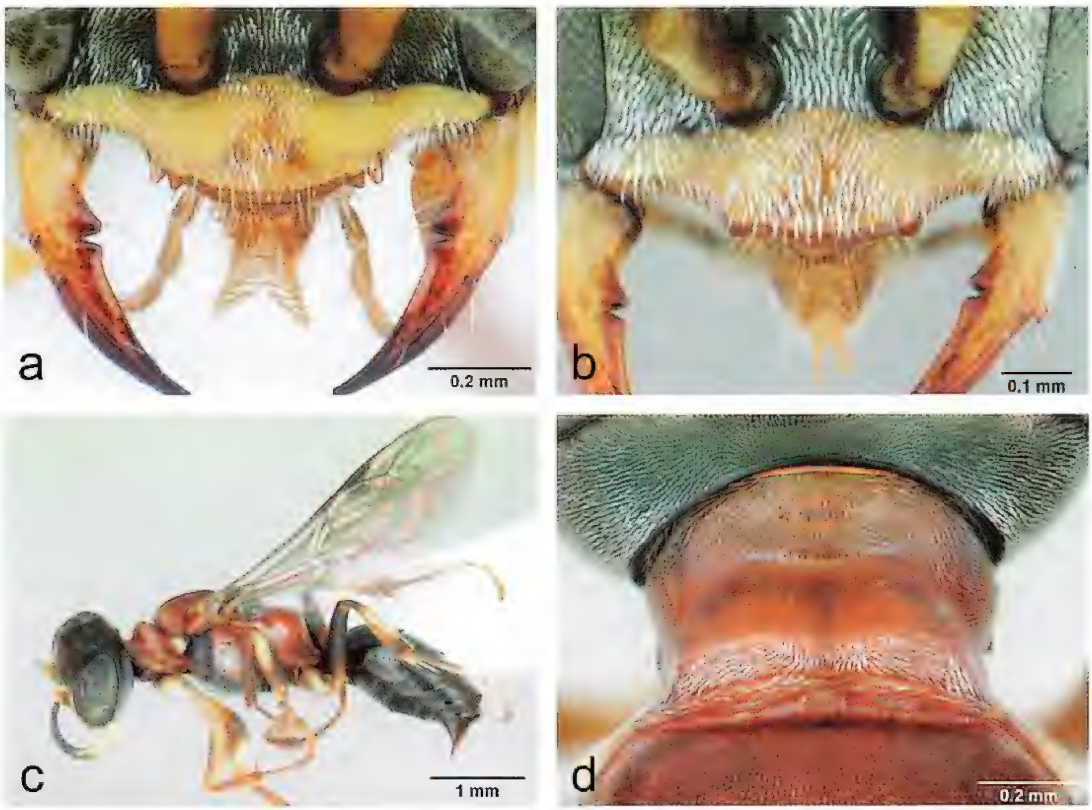

FIGURE 176. *Sericophorus rufoniger* (Turner): a – female clypeus in frontal view; b – male clypeus in frontal view; c – female body in lateral view; d – female pronotum in dorsal view.

yellow apical spot, the hindtibia is pale yellow dorsally (at least partly so), and in the male the greatest length of flagellomere IX is about 1.0 × apical width. In *mimus*, the clypeus, mesopleuron, and forecoxa are all black, whereas the femora, tibiae, and tarsi are all reddish brown, and in the male the greatest length of flagellomere IX is about 0.5 × apical width.

Description.— Frontal punctures ill defined, minute, shallow, almost compressed against each other; frontal line shiny, not extending into frons upper half. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to about 0.75 × hindocellar width. Clypeal lamella slightly arcuate (Fig. 176a, b). Pronotal collar thickened, markedly longer than in other *Sericophorus* except *mimus* (Fig. 176d). Scutal punctures minute but well defined, slightly more than one diameter apart near center; interspaces unsculptured, shiny; scutal flange ending abruptly. Mesopleural punctures smaller than those on scutum, less than one diameter apart; interspaces unsculptured, shiny. Propodeal dorsum with well-defined median carina, without median sulcus or impression, in most specimens minutely, obliquely ridged, with punctures between ridges (ridges absent in some specimens); side unsculptured; posterior surface minutely punctate (except for median sulcus). Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular. Hindfemur slenderer than average for genus. Tergum I with microscopic punctures that are many diameters apart in female and 3–4 diameters apart in male; interspaces with evanescent microsculpture, shiny; apical depressions of terga I and II impunctate.

Frontal setae silvery (golden dorsally in female), partly concealing integument ventrally in female, totally so in some males; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

Head black except the following: clypeus, scape, and pedicel pale yellow (clypeus narrowly brown along lamella); flagellum in many females pale yellow, markedly darkened dorsally, in other females and in male nearly all black, with apical flagellomere largely pale yellow; and mandible yellow basally, dark brown apically. Thorax and propodeum reddish brown except the following black: scutellum, metanotum, and mesothoracic venter (all or only mesally), also upper precpisternal area in some specimens; pronotal lobe pale yellow. Coxae and trochanters pale yellow or partly or all reddish brown; forefemur pale yellow ventrally and apically, reddish brown dorsally (all black basally in some specimens); midfemur in female yellow apically and ventrally, reddish brown dorsally, in male yellow apically and ventrally, almost black basally and dorsally; hindfemur in female dark brown dorsally (yellowish brown ventrally in some specimens), black in male; tibiae reddish, partly yellow (only hindtibia in female); tarsi reddish in female, yellow in male. Gaster black.

♀.— Orbital fovea matt, extending to hindocellus, shallowly concave. Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X 1.8 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate not obscuring integument. Length 4.3–4.8 mm.

♂.— Dorsal length of flagellomere I 0.75 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX about 1.0 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with four or five rake spines. Sternum VIII: Fig. 177a. Genitalia: Fig. 177b. Length 3.4–4.7 mm.

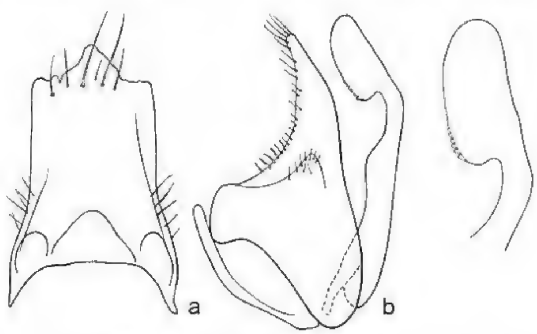

FIGURE 177. *Sericophorus rufoniger* (Turner): a – sternum VIII of male; b – male genitalia in lateral view, with outline of penis valve.

Geographic distribution (Fig.175).— Northern Territory and Queensland.

Records: AUSTRALIA: Northern Territory: McArthur River 2 km SSE of Borroloola at 16°05′S 136°19′E, 20 Apr 1976 (2 ♀, ANIC); Darwin, Dec 1902 (3 ♂, BMNH, lectotype and paralectotypes of *Zoyphium rufonigrum*, as Port Darwin); Keep River National Park at 15°44′17″S 129°06′55″E, 7–8 and 8–9 June 2001 (2 ♀, ANIC; 2 ♀, CAS; 2 ♀, USU); Nourlangie Creek 8 km N Mt. Cahill at 12°48′S 132°42′E, 19–20 Nov 1972 (1 ♂, ANIC); 38.5 km SW Timber Creek on Victoria Highway at 15°42′40″S 130°07′48″E, 6–13 June 2001 (1 ♂, CAS; 5 ♀, 1 ♂, USU) and 13–19 June 2001 (1 ♀, CAS; 2 ♂, USU). **Queensland**: 3.5 km SSW Mt. Baird at 15°10′S 145°07′E, 3–5 May 1981 (1 ♂, ANIC); Wonga Beach 11 km NNE Mossman at 16°19.9′S 145°25.3′E, 20–22 Nov 2006 (14 ♀, 26 ♂, CAS), 9 May 2007 (3 ♀, AMS; 4 ♀, CAS), 14 May 2007 (1 ♂, CAS). **Western Australia:** 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003 (1 ♀, ANIC, 1 ♀, USU).

***Sericophorus rufus* Pulawski, sp. nov.**

Figures 175, 178.

Name derivation.— *Rufus*, Latin masculine adjective meaning *red*; an allusion to this species reddish brown gaster and legs.

Recognition.— *Sericophorus rufus* has the setae erect on the upper frons and postocellar area and shares a unique coloration with *barakula*: the head, thorax, and propodeum are black, whereas the gaster, femora, tibiae and tarsi are reddish brown. Unlike *barakula*, the clypeal lamella is narrow in *rufus*, the distance between the inner teeth being equal to the clypeal midlength (Fig. 178) rather than 1.3 × clypeal midlength.

Figure 178. *Sericophorus rufus* Pulawski, sp. n.: female clypeus in frontal view.

Description (based on holotype only).— Frontal punctures averaging about one diameter apart. Frontal line reaching midocellus. Ocellocular distance equal to 0.9 × hindocellar width. Interocellar area convex adjacent to hindocellus, concave mesally. Scutal punctures averaging about one diameter apart; scutal flange gradually narrowing posterad. Mesopleural punctures several diameters apart below scrobe; interspaces shiny, almost unsculptured. Propodeal dorsum punctate, adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, well-defined, glabrous, longitudinal sulcus; the latter with several transverse carinae and short longitudinal carina; side ridged, unsculptured basally, separated from posterior surface by longitudinal, zigzagging carina; posterior surface punctate except for median sulcus, ridged laterally. Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly. Tergum I concave anteriorly, punctures of horizontal area averaging about 2–3 diameters apart; apical depression impunctate; apical depression of tergum II punctate (except along hindmargin).

Setae of lower frons and clypeus silvery, not obscuring integument; erect on upper frons, postocellar area, and scutum; on interocellar area about as long as 0.6 × midocellar width; on scutum suberect, about 0.2 × as long as midocellar width; suberect, oriented anterad on propodeal dorsum.

Head, thorax, and propodeum black except clypeus dark reddish brown adjacent to lamella, antenna reddish brown, and mandible reddish basally, dark brown apically. Femora, tibiae, tarsi, and gaster reddish brown.

♀.— Orbital fovea moderately well defined, wider than half ocellocular distance. Clypeal lamella narrow, distance between inner teeth equal to clypeal midlength (Fig. 178). Dorsal length of flagellomere I 1.4 × apical width, of flagellomere II 1.2 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with six rake spines. Setae of pygidial plate concealing integument near apex. Length 6.3 mm.

♂.— Unknown.

Geographic distribution (Fig. 175).— Known from one locality in Queensland.

Records.— Holotype: ♀, **AUSTRALIA: Queensland**: Mount Moffatt National Park at 25°03′S 147°53′E, 27 Nov 1997, Lambkin, Evans, and Skevington (QMB).

Sericophorus sabulosus Lomholdt, sp. nov.

Figures 179–181.

Name derivation: *Sabulosus*, Latin masculine adjective meaning *of sand* or *belonging to sand*.

Recognition.— *Sericophorus sabulosus* is one of the three species that have a metallic green head, thorax, propodeum, gaster, and femora, ocellocular distance equal to 0.7–0.9 × hindocellar width, setae erect on the upper frons and postocellar area, and the basal declivity of tergum I concave. It also has an evenly convex scutellum and finely, evenly punctate propodeal dorsum on each side of the median sulcus. Unlike the other two (*evansi* and *viridescens*), the antenna of *sabulosus* is predominantly black rather than yellowish brown or reddish brown. The elongate forebasitarsal rake is a subsidiary recognition feature (length of apical spine about 2.1 × apical width of basitarsus in female, 1.6 × in male, whereas 1.3 × in *evansi*).

Description.— Frons swollen near center; frontal punctures averaging about one to two diameters apart, more than that near top of swelling; frontal line ill defined, ending dorsally in shallow, unsculptured depression near frontal midheight; interocellar area convex adjacent to hindocellus, concave mesally. Ocellocular distance equal to 0.9 × hindocellar width in female, to 1.0 × in male. Most scutal punctures two or three diameters apart near center; scutal flange gradually narrowing toward apex. Mesopleural punctures averaging several diameter apart near center. Propodeal dorsum adjacent to foremargin with deep, crenulate sulcus that extends mesally into well-defined, longitudinal sulcus; the latter almost as wide posteriorly as length of metanotum and crossed by one to three transverse carinae; remaining surface punctate (some interspaces merging into minute rugae); side sparsely punctate except impunctate anteriorly, delimited from posterior surface by oblique ridges that are crossed by longitudinal, zigzagging ridge (longitudinal ridge

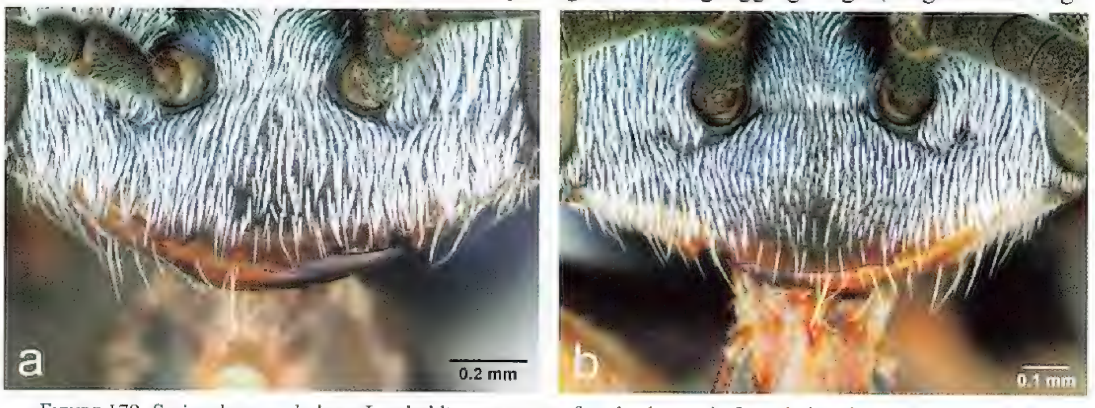

Figure 179. *Sericophorus sabulosus* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view.

almost straight in one male); posterior surface ridged (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly. Forecoxal venter sparsely punctate. Anterior declivity of tergum I concave; horizontal area with punctures averaging about two diameters apart. Apical depressions of terga I and II minutely punctate except impunctate along hindmargin.

Setae silvery on frons and clypeus, largely concealing integument except on upper frons, not concealing in one male; erect on upper frons and postocellar area, about as long as midocellar width on interocellar area; silvery, subappressed, about as long as 0.4 × midocellar width on scutum; nearly appressed on propodeal dorsum.

Head, thorax, propodeum, and gaster metallic green with following exceptions: clypeus dark reddish along lamella; mandible yellowish basally, reddish brown mesally, dark brown apically; antenna black, apical half of flagellum brown ventrally in female, only flagellomeres VII-IX or VIII and X in male; pronotal lobe partly brown; pygidial plate in female and tergum VII in male brown. Femora black with bluish or greenish luster; foretibia yellowish brown; foretarsus brown except apical tarsomere yellowish brown; mid- and hindtibiae and tarsi dark brown.

♀.— Orbital fovea ill defined. Clypeal lamella minimally arcuate, lateral tooth only slightly protruding (Fig. 179a). Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II as long as apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.1 × basal width. Forebasitarsus with six rake spines, length of apical spine 2.1 × apical width of basitarsus. Setae of pygidial plate not concealing integument. Length 6.0–6.5 mm.

♂.— Free margin of clypeal lamella slightly arcuate, almost straight, with one lateral tooth on each side (Fig. 179b). Antenna clavate; dorsal length of flagellomeres I and II 0.9 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.2 × basal width. Sternum VIII emarginate apically (Fig. 180a). Genitalia: Fig. 180b. Length 4.8–5.3 mm.

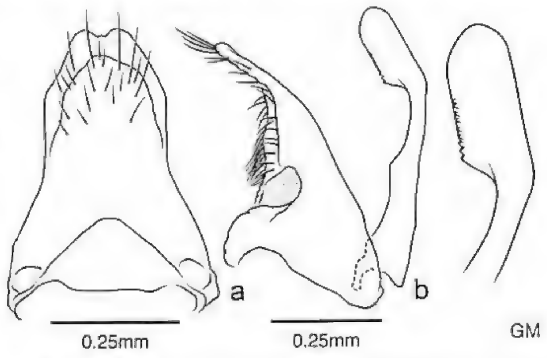

FIGURE 180. *Sericophorus sabulosus* Lomholdt, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view, with outline of penis valve.

GEOGRAPHIC DISTRIBUTION (Fig. 181).— Known from two adjacent localities in Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Western Australia:** Goongarrie at 29°55′S 121°08′E, dune top, Oct 1980, W.F. Humphreys

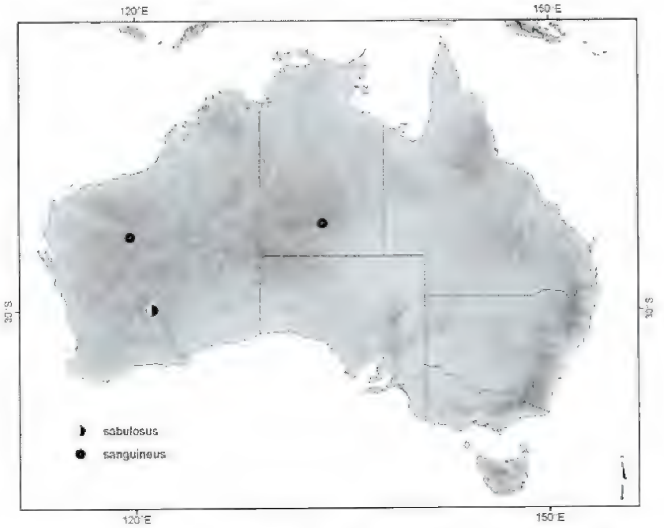

FIGURE 181. Collecting localities of *Sericophorus sabulosus* and *sanguineus*.

et al. (WAMP). PARATYPE: **AUSTRALIA**: **Western Australia**: 22 km N Bullfinch at 30°59′S 119°06′E, 2–3 Oct 1961, T.F. Houston (1 ♂, ANIC; 1 ♂, WAMP); Goongarrie, 29°55′10″S 121°14′45″E, in *Atriplex*, Oct 1980, W.F. Humphreys (1 ♀, CAS).

***Sericophorus sanguineus* Lomholdt, sp. nov.**
Figures 181, 182.

NAME DERIVATION.— *Sanguineus*, Latin masculine adjective meaning *bloody*; with reference to the color of legs and gastral apex.

RECOGNITION.— *Sericophorus sanguineus* has the upper frons and postocellar area covered with erect setae, the anterior declivity of tergum I concave, the frons, thorax, propodeum, and gaster black (gastral apex bright reddish), the ocellocular distance equal to 0.9 × hindocellar width, and the propodeal side separated from the posterior side by a zigzagging, longitudinal ridge that crosses the oblique ridges. *Sericophorus triangularis* is similar, but *sanguineus* differs in having the clypeal lamella slightly arcuate, rather than markedly arcuate, the lateral clypeal tooth nonprominent (Fig. 182) rather than prominent, the postocellar area somewhat swollen mesally adjacent to the interocellar area (rather than not swollen), the pronotal collar attaining the level of the scutum (rather than not attaining), the glabrous median sulcus of propodeal dorsum parallel-sided except basally (rather than broadening anterad), and the foretarsus and foretibia uniformly reddish brown (rather than foretarsomeres I-IV dark brown). The bright reddish gastral segments V and VI are a subsidiary recognition feature.

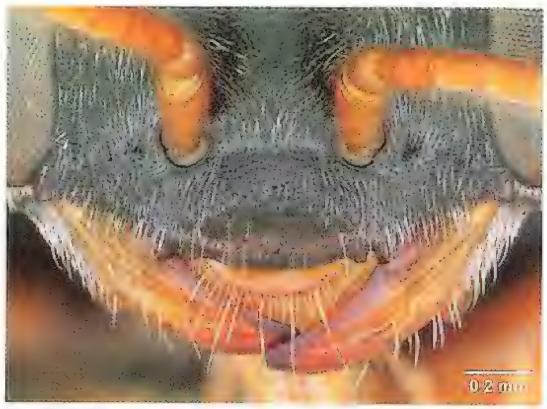

FIGURE 182. *Sericophorus sanguineus* Lomholdt, sp. nov.: female clypeus in frontal view.

DESCRIPTION.— Frontal punctures less than one diameter apart except about one diameter apart mesally. Frontal line in holotype ending at about frontal midheight as shiny, oval depression, reaching midocellus in paratype. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.8–0.9 × hindocellar width. Interocellar area convex adjacent to hindocellus, concave mesally; postocellar area somewhat swollen mesally adjacent to interocellar area. Clypeal lamella slightly arcuate (Fig. 182). Scutal punctures well defined, varying from about one to about two diameters on disk; scutal flange gradually narrowing posterad. Scutellum markedly convex, uniformly punctate. Mesopleural punctures about 2–3 diameters near center. Propodeal dorsum punctate, adjacent to foremargin with deep, crenulate sulcus that extends mesally into well-defined, glabrous, longitudinal sulcus; longitudinal sulcus transversely carinate and with median, longitudinal carina; side finely ridged except practically unsculptured anteriorly, separated from posterior surface by series of oblique ridges that are crossed by zigzagging longitudinal carina; posterior surface ridged (except for median sulcus) in holotype, punctate in paratype, unsculptured mesodorsally. Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly, nearly triangular. Tergum I concave anteriorly, punctures of horizontal area averaging about 1–2 diameters part, interspaces unsculptured (except on apical depression in holotype); apical depressions of terga I and II punctate except along hindmargin. Sternum I with double median ridge basally.

Setae of lower frons and clypeus sparse, silvery, not obscuring integument; erect on upper

frons and postocellar area; on interocellar area about as long as 0.5 × midocellar width; on scutum dark, suberect, 0.3–0.4 × midocellar width; suberect, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except mandible yellowish reddish basally, reddish brown in distal half, and dark brown at very apex; antenna reddish brown but scape and apical flagellomeres dark dorsally; pronotal lobe brownish along posterior margin in holotype; femora, tibiae, and tarsi bright reddish; and gastral segments V and VI bright reddish.

♀.— Orbital fovea matt, ill defined, about as wide as half ocellocular distance Dorsal length of flagellomere I 1.2 × apical width, of flagellomere II 1.1 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with six or seven rake spines. Setae of pygidial plate partly concealing integument. Length 6.3–7.5 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 181).— Northern Territory and Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Northern Territory**: 33 km WNW Alice Springs at 23°36′S 133°34′E, 30 Sept 1978, J.C. Cardale (ANIC). PARATYPE: **Western Australia:** 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003, F.D. Parker and M.E. Irwin (1 ♀, ANIC).

***Sericophorus scintillans* Pulawski, sp. nov.**
Figures 183, 184.

NAME DERIVATION.— *Scintillans*, present participle of the Latin verb *scintillare*, to sparkle, to shine; an allusion to this species coloration.

RECOGNITION.— *Sericophorus scintillans* has the setae erect on the upper frons, postocellar area, frons, gena, and thorax, a metallic green propodeum, largely reddish brown gaster, and the propodeal side separated from the posterior surface by a zigzagging, longitudinal carina. *Sericophorus bicolor* is similar, but in *scintillans* the frontal punctures are less than one diameter apart and partly obscured by pilosity, the ocellocular distance is equal to 0.8 × hindocellar width, the upper mesopleuron is nearly completely concealed by setae, the mid- and hindfemora are nearly all reddish brown, and terga I-III have green or blue metallic spots

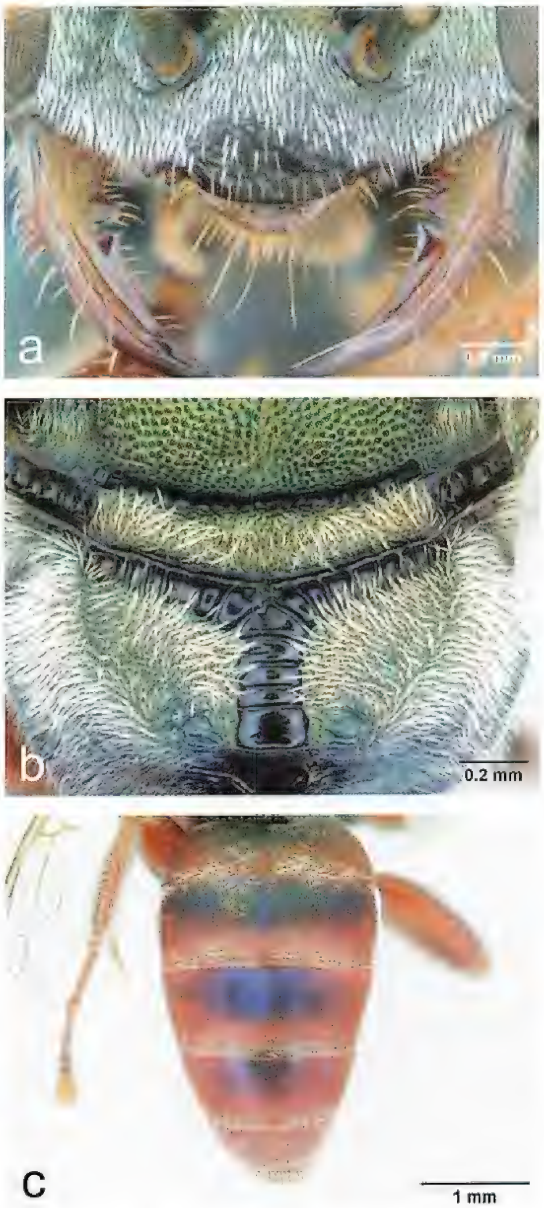

FIGURE 183. *Sericophorus scintillans* Pulawski, sp. nov. ♀: clypeus in frontal view; b – part of scutellum metanotum, and propodeal dorsum in dorsal view; c – gaster in dorsal view.

(Fig. 183c). In *bicolor*, the frontal punctures, near the center, are more than one diameter apart in the female, about one diameter apart in the male, the sculpture is not obscured by pilosity, the ocellocular distance is equal to 1.0 × hindocellar width, the mesopleuron is not obscured by pilosity, the mid- and hindfemora are black in many specimens (but reddish brown in some), and the terga are all reddish brown.

Description (based on holotype only).— Frontal punctures less than one diameter apart. Frontal line extending to midocellus. Antennal socket separated from clypeal free margin by slightly less than two socket widths. Ocellocular distance equal to 0.8 × hindocellar width. Scutal punctures less than one diameter apart; scutal flange gradually narrowing posterad. Most mesopleural punctures less than one diameter apart. Propodeal dorsum punctate (punctures less than one diameter apart), deeply crenulate along foremargin and with deep, median sulcus that is crossed by transverse carinae, ridged apically adjacent to sulcus (Fig. 183b); side ridged and finely punctate (except unsculptured anteriorly), separated from posterior surface by longitudinal, slightly zigzagging ridge; posterior surface finely ridged and punctate (except for median sulcus), coarsely rugose laterally. Forewing vein M interstitial with cu-a; second submarginal cell open at radial margin. Tergum I concave anteriorly, punctures of horizontal area about one diameter apart; apical depressions of terga I and II punctate except impunctate along hindmargin.

Setae of lower frons and clypeus silvery, obscuring integument; erect on upper frons and postocellar area; on interocellar area about as long as 0.6–0.7 × midocellar width; most scutal setae appressed, largely obscuring integument in anterior third or so, but several setae suberect, 0.4 × as long as midocellar width; appressed, oriented obliquely anterad on propodeal dorsum.

Clypeus black, upper frons, occiput, gena, thorax, and propodeum metallic green; scape and pedicel black, flagellum dark dorsally, reddish brown ventrally; mandible yellowish basally, brown mesally and apically. Forefemur reddish brown dorsally, metallic green ventrally; midfemur reddish brown; hindfemur reddish brown, narrowly dark dorsally; tibiae reddish brown; tarsi brown. Gaster reddish brown except tergum I mesally and tergum II basally are metallic green (metallic area wider toward apex on tergum I); tergum III metallic blue basally (Fig. 183c).

♀.— Orbital fovea wider than half ocellocular distance. Free margin of clypeal lip arcuate (Fig. 183a). Dorsal length of flagellomere I 1.2 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with five rake spines. Setae of pygidial plate not concealing integument. Length 8.3 mm.

♂.— Unknown

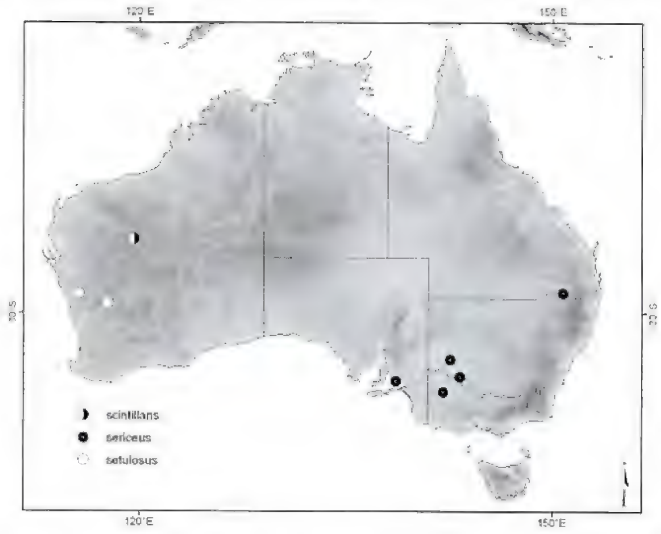

Figure 184. Collecting localities of *Sericophorus scintillans*, *sericeus*, and *setulosus*.

Geographic distribution (Fig. 184).— Known from one locality in Western Australia.

Records.— Holotype: ♀, **AUSTRALIA**: **Western Australia**: 158 km S Newman (= 9 km N Kuma-

rina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003, F.D. Parker and M.E. Irwin (ANIC).

***Sericophorus sericeus* (Kohl)**
Figures 184–187.

Zoyphium sericeum Kohl, 1893:571, ♀. Holotype: ♀: South Australia: Adelaide (ZMHU), examined by O. Lomholdt and W. Pulawski.— Turner, 1914:354 (in revision of Australian *Zoyphium*).— As *Sericophorus sericeus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:253 (in catalog of Australian Sphecidae).

Recognition.— Tergum I of *sericeus* has a conspicuous, lateral, spine-like projection on which the spiracle is located (Fig. 186c), and the basolateral carina extends beyond the anterior margin of the spiracle. Also, the clypeal median section is elevated, the ventral portion of the elevation is concave, glabrous (Fig. 185a-e), the posterior mandibular margin convex between the base and notch, the pronotal collar is pale yellow, the scutellum and metanotum are reddish brown, and male flagellomere III has a ventral tooth (Fig. 186b). *Sericophorus cornutus*, *nasicornis*, and *rhinoceros* are similar, but they differ in having the straight posterior mandibular margin and also by the shape of the clypeus and color of the thorax and propodeum. See these species for details.

Description.— Frontal punctures minute, less than one diameter apart; frontal line shiny, not extending above frontal midheight. Midocellus in shallow depression. Ocellocular distance equal to 0.7–1.0 × hindocellar width. Middle clypeal section elevated, ventral portion of elevation triangular, concave, glabrous (Fig. 185a-e); elevation prominent in many males. Posterior mandibular tooth protruding obliquely anterad, with oblique carina; posterior margin convex between base and notch. Propleuron conspicuously prominent posterolaterally, prominence oriented anterad. Scutal punctures less than one diameter apart; interspaces microareolate; scutal flange ending abruptly. Mesopleural punctures about two diameters apart near center; interspaces unsculptured, shiny. Propodeal dorsum with short longitudinal ridges adjacent to foremargin, with median, longitudinal impression and median carina, remainder punctate; side minutely punctate; posterior surface punctate (except for median sulcus). Forewing vein M diverging from M+Cu basad of, but close to, cu-a (especially in male); second submarginal cell triangular or narrowly open anteriorly. Tergum I laterally with conspicuous spiny projection on which spiracle is located (Fig. 186c), spiracle slit-like (Fig. 186b); basolateral carina ending behind anterior margin of spiracle; horizontal area of tergum I, as well as following terga, with punctures that average about one diameter apart; apical depressions of terga I and II punctate. Male sternum I basally with elevation that ends in semicircular emargination at about sternal midlength.

Setae silvery, concealing integument on lower frons laterally, appressed on upper frons, postocellar area, and scutum; on propodeal dorsum subappressed, oriented anterad.

Head black except the following: female clypeus yellowish white (lateroclypeal sutures slightly darkened), male clypeus reddish brown, middle section with effaced yellow spot laterally; scape yellow in female, reddish brown in male, flagellomeres I-IV reddish brown, following ones darkened to black dorsally; mandible reddish brown, dark apically, pale yellow basally in female. Pronotum black anteriorly; collar pale yellow, reddish anteriorly; pronotal lobe pale yellow in female, yellowish red in male; scutellum and metanotum reddish brown; propodeum black, partly reddish brown (largely so in some specimens). Legs mainly reddish brown, but forecoxal venter yellow and forefemur pale yellow apicoventrally (also midfemur in female). Gaster black, tergum I largely reddish brown mesally, tergum VI reddish brown (also tergum VII in male); apical depressions of terga yellowish.

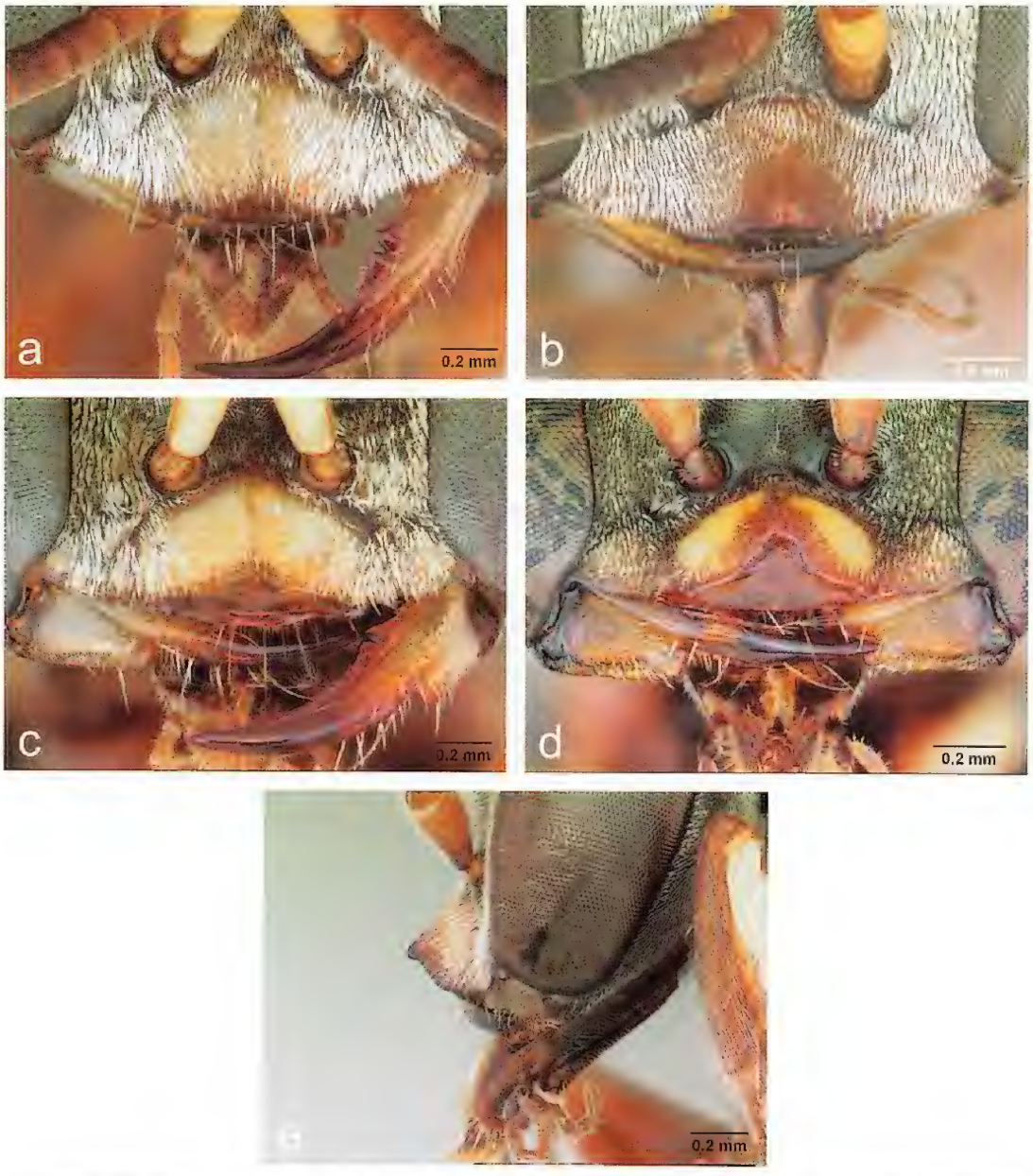

FIGURE 185. *Sericophorus sericeus* (Kohl): a – female clypeus in frontal view; b – male clypeus in frontal view; c – female clypeus in ventral oblique view; d – male clypeus in ventral oblique view; e – male clypeus in lateral view.

♀.— Orbital fovea matt, about as wide as half ocellocular distance. Dorsal length of flagellomere I 1.3 × apical width, of flagellomere II 1.4 × apical width (Fig. 186a); greatest length of flagellomere IX 1.0 × apical width, of flagellomere X 2.0 × basal width. Forebasitarsus with six or seven rake spines. Setae of pygidial plate completely concealing integument near apex. Length 9.0–11.5 mm.

♂.— Clypeal lamella with inconspicuous, lateral tooth. Flagellomere I convex ventrally, flagellomere III with ventral tooth (Fig. 186b). Dorsal length of flagellomere I 1.0 × apical width, of

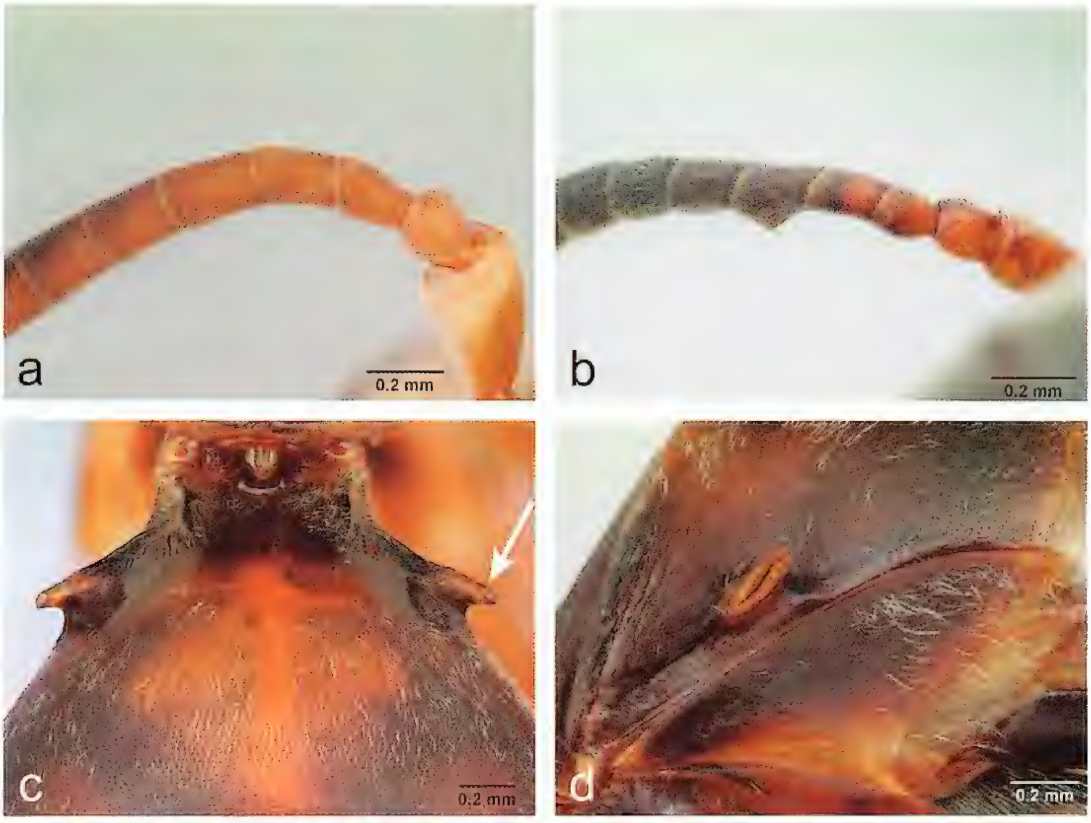

FIGURE 186. *Sericophorus sericeus* (Kohl): a – base of female flagellum; b – base of male flagellum; c – female tergum I in dorsal view (arrow indicates position of stigma); d – gastral segment I of female I in lateral view.

flagellomere II 1.2 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X 1.4 × basal width. Posterior mandibular margin convex between articulation and posteroventral tooth, at least slightly so. Forebasitarsus with 5–7 rake spines. Sternum VIII: Fig. 187a. Genitalia: Fig. 187b. Length 7.1–9.0 mm. Forecoxal venter pale yellow.

GEOGRAPHIC DISTRIBUTION (Fig. 184).— Southeastern Australia.

RECORDS.— **AUSTRALIA**: **New South Wales**: 30 km W Balranald, 30 Nov 1993 (1 ♀, SAM); Pooncarie, 26 Nov 1991 (2 ♂, AMS; 3 ♂, CAS), 27 Nov 1991 (4 ♂, AMS), 30 Nov 1993 (1 ♂, AMS). **Queensland**: Yelarbon, Jan 1959 (1 ♂, UQIC). **South Australia:** Adelaide (2 ♀, ZMHU including holotype of *Zoyphium sericeum*). **Victoria**: Yaapeet, 18–22 Feb 1970 (1 ♂, MCZ).

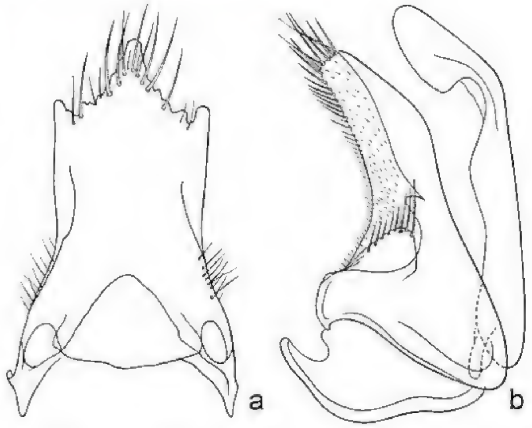

FIGURE 187. *Sericophorus sericeus* (Kohl): a – sternum VIII of male; b – male genitalia in lateral view.

***Sericophorus setulosus* Lomholdt, sp. nov.**
Figures 184, 188.

NAME DERIVATION.— *Setulosus*, Latin masculine adjective meaning *with fine setae*; with reference to the conspicuous, abundant vestiture of this species.

RECOGNITION.— *Sericophorus setulosus* has the setae erect on the upper frons and postocellar area, black frons, gena, and gaster (gastral apex reddish brown), and tergum I longitudinally concave basally. It differs from similar species by its unusually long setae that are about 1.5 × midocellar width on the interocellar area (Fig. 188a, c), up to 1.5 × midocellar width on scutum anteriorly (most scutal setae 0.9–1.0 × midocellar width), up to 2.0 × midocellar width on lower mesopleuron and fore- and midfemoral venter (Fig. 188e), and up to 1.5 × midocellar width on hindfemoral venter (Fig. 188f). Additionally, the ocellocular distance is equal to 1.2 × hindocellar width, and the propodeal side is separated from the posterior surface by a series of oblique ridges but no longitudinal ridge.

DESCRIPTION.— Head wider than average for *Sericophorus* (Fig. 188a). Frons swollen near center; frontal punctures evanescent, several diameters apart, interspaces conspicuously microareolate, dull; frontal line well defined but not reaching midocellus. Interocellar area convex adjacent to hindocellus, concave mesally. Ocellocular distance equal to 1.2 × hindocellar width. Scutal punctures several diameters apart, somewhat ill defined because of conspicuously microareolate interspaces; scutal flange widest preapically, gradually narrowing toward apex. Mesopleural punctures averaging several diameters apart near center (Fig. 188d). Scutellum slightly swollen along midline, swelling slightly shiny, contrastingly less microsculptured than adjacent areas (that are dull). Propodeal dorsum finely punctate; adjacent to foremargin with deep, crenulate sulcus that extends mesally into well-defined, glabrous, longitudinal sulcus; the latter with several transverse carinae, with longitudinal carina at very base; side microareolate, dull, finely punctate, separated from posterior surface by series of short, transverse carinae (but not longitudinal carina); posterior surface (except for median sulcus) dull, markedly microsculptured, with evanescent punctures and fine ridges. Forewing vein M interstitial with cu-a; second submarginal cell conspicuously narrowed anteriorly. Horizontal area of tergum I with minute punctures that are several diameters apart; interspaces shiny, finely microareolate; anterior declivity markedly longitudinally concave; apical depressions of terga I and II narrowly impunctate next to hindmargin.

Setae unusually long on head, thorax, propodeum, and femora; not obscuring integument on frons and clypeus; erect on upper frons, postocellar area (Fig. 188a, c), scutum, and propodeal dorsum; setal length expressed as midocellar width: at least 1.5 × along posterior mandibular margin between base and notch, about 1.5 × on interocellar area, on scutum up to 1.5 × anteriorly (most scutal setae 0.9–1.0 ×), up to 2.0 × on lower mesopleuron (Fig. 188d) and fore- and midfemoral venters (Fig. 188e), up to 1.5 × on hindfemoral venter (Fig. 188f); setae silvery except darkened on upper frons and postocellar area.

Head, thorax, propodeum, and gaster black except the following are reddish brown: small dorsal area on pedicel; flagellum (apical two-thirds of apical flagellomere black); mandibles beyond notch (dark brown apically); preapical area of tergum V and gastral segment VI. Legs reddish brown except coxae and trochanters black, also fore- and midfemora basally.

♀.— Orbital fovea absent. Clypeal lamella straight, lateral tooth nonprominent (Fig. 188b). Dorsal length of flagellomere I 1.4 × apical width, that of flagellomere II 1.1 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.5 × basal width. Forebasitarsus with six or seven rake spines. Setae of pygidial plate largely concealing integument. Length 8.3–8.6 mm.

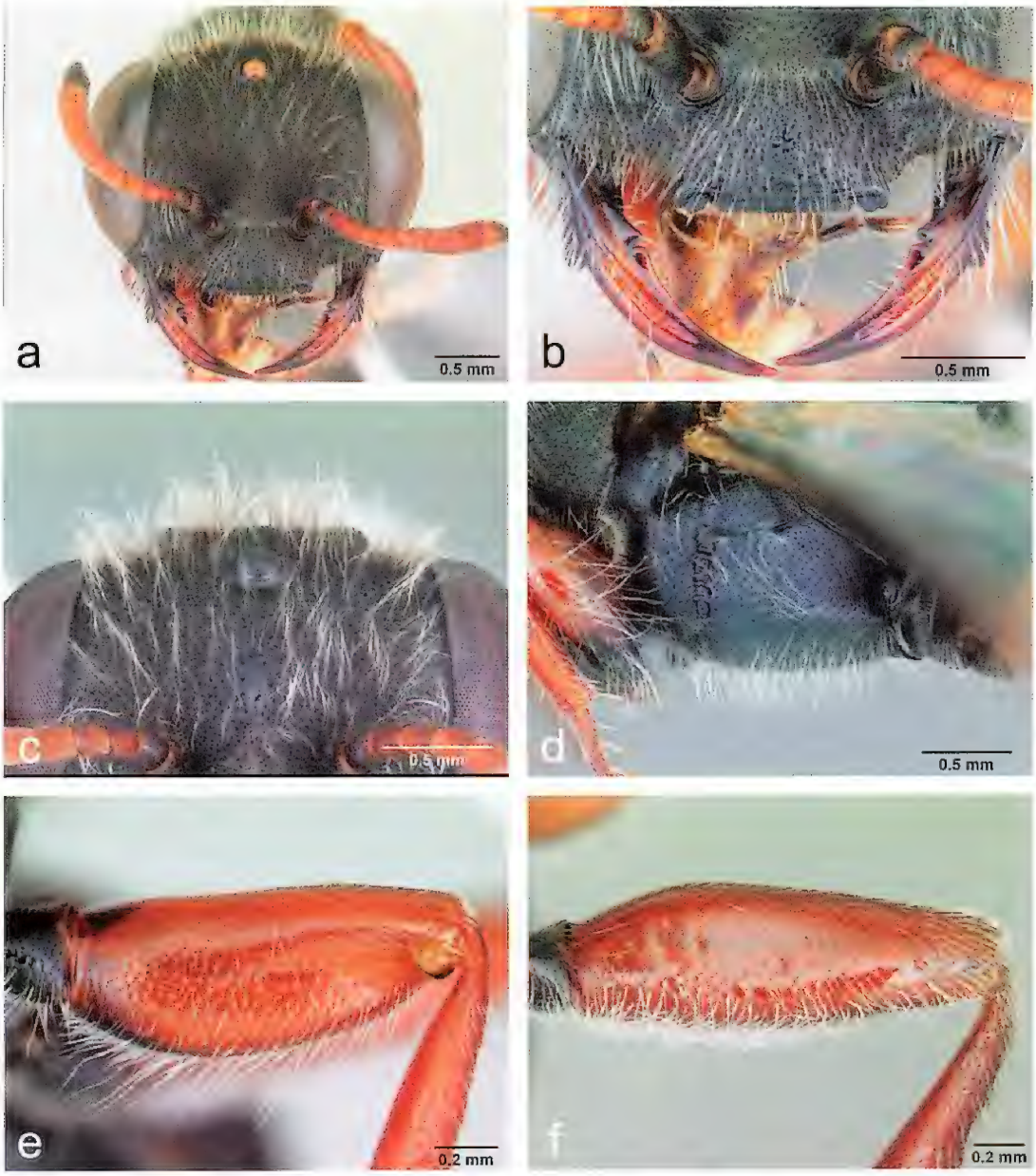

FIGURE 188. *Sericophorus setulosus* Lomholdt, sp. nov.: a – female head in frontal view; b – female clypeus in frontal view; c – upper frons and vertex of female in frontal view; d – female mesopleuron; e – female midfemur; f – female hindfemur.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 184).— Known from two localities in Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Western Australia**: 5 km WSW Paynes Find at 29°18′S 117°39′E, 29 Sept 1981, I.D. Naumann and J.C. Cardale (ANIC). PARATYPE: **AUSTRALIA: Western Australia**: 10 km S of Mullewa (which is 28.53°S 115.51°E), 2 Aug 1983, B.B. Lowery (1 ♀, CAS).

***Sericophorus sparsus* Pulawski, sp. nov.**
Figures 189, 190.

NAME DERIVATION.— *Sparsus*, Latin for *sparse*; with reference to the conspicuously sparse frons punctation of this species.

RECOGNITION.— *Sericophorus sparsus* can be recognized by its dull, microsculptured frons with a few inconspicuous, sparse punctures (Fig. 189a). Subsidiary recognition features are: ocellocular distance equal to 0.6 × hindocellar width, scutum, mesothoracic venter, and female pygidial plate densely punctate (punctures about one diameter apart), propodeal dorsum rugose, foretarsomere IV wider than long, antenna and fore- and midfemora pale yellow, and hindfemur yellowish brown.

DESCRIPTION (based on holotype only).— Inner orbits nearly parallel. Frons dull, microsculptured, with inconspicuous, minute punctures that are many diameters apart (Fig. 189a). Frontal line recognizable only in frons ventral half. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.6 × hindocellar width. Pronotal collar not reaching level of scutum. Propleuron prominent posterolaterally (expansion oriented anterad). Scutal punctures averaging about one diameter apart; scutal flange ending abruptly. Mesopleuron behind episternal sulcus finely microsculptured but shiny, with microscopic punctures that are several diameters apart. Propodeal dorsum rugose, with broad, glabrous, median sulcus that contains median carina and several transverse carinae; side mainly unsculptured, with a few minute ridges, separated from posterior surface by longitudinal carina; posterior surface finely, irregularly sculptured except for median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell open anteriorly. Horizontal area of tergum I with a few, scattered microscopic punctures; apical depression impunctate; apical half of tergum II with only a few microscopic, scattered punctures, apical depression impunctate.

Setae of lower frons and clypeus silvery, not obscuring integument; appressed on upper frons, postocellar area, and scutum; inconspicuous, appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following are pale yellow: mandible (brown apically), clypeal lateral section, antenna (apical flagellomere brown apically), humeral plate, fore- and mid femora, tibiae and tarsi, hindtibia (except light brown basodorsally) and hindtarsus; clypeal middle lobe with narrow reddish brown strip adjacent to lamella; hindfemur yellowish brown.

♀.— Free margin of clypeal lobe arcuate (Fig. 189b). Orbital fovea ill defined. Dorsal length

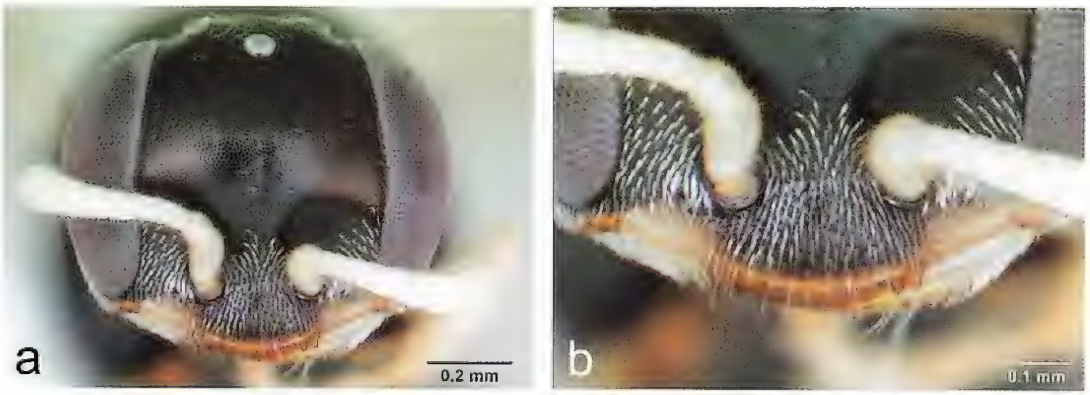

FIGURE 189. *Sericophorus sparsus* Pulawski, sp. nov.: a – female head in frontal view; b – female clypeus in frontal view.

of flagellomeres I and II about 0.8 × apical width; greatest length of flagellomere IX about 0.8 × apical width, of flagellomere X 1.4 × basal width. Forebasitarsus with six rake spines; foretarsomere IV wider than long. Setae of pygidial plate largely concealing integument. Length 3.2 mm.

♂.— Unknown.

Geographic distribution (Fig. 190).— Known from one locality in Northern Territory.

Records.— Holotype: ♀, **AUSTRALIA: Northern Territory**: Keep River National Park at 15°57′33″S 129°01′44″E, 3–8 June 2001, M.E. Irwin, F.D. Parker, and C. Lambkin (ANIC).

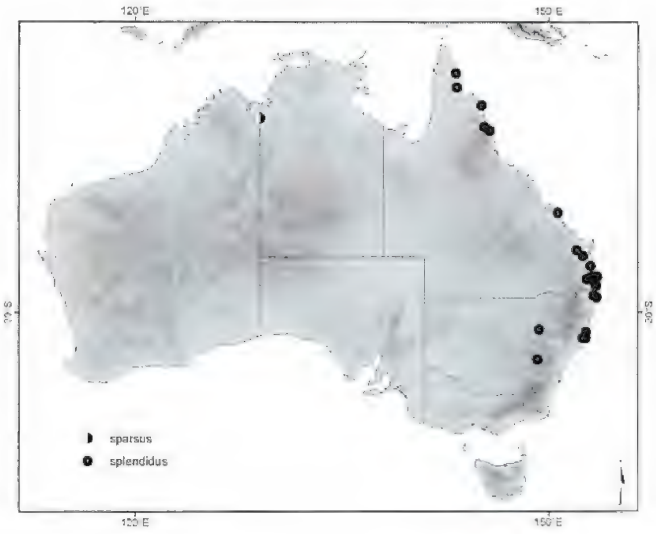

Figure 190. Collecting localities of *Sericophorus sparsus* and *splendidus*.

Sericophorus splendidus (Hacker and Cockerell)

Figures 190–192.

Zoyphium splendidum Hacker and Cockerell, 1922:288, ♀, ♂ (♂ = *Sericophorus tuberculatus*). Lectotype: ♀, Australia: Queensland: Brisbane (QMB), **present designation by O. Lomholdt**, examined by O. Lomholdt and W. Pulawski.— As *Sericophorus splendidus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:254 (in catalog of Australian Sphecidae).

Anacrucis cingulata Rayment, 1955a:57, ♀. Holotype: ♀, Australia: New South Wales: Millthorpe (BCRI), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— As *Sericophorus cingulatus*: Bohart and Menke, 1976:302 (new combination, listed); Cardale, 1985:251 (in catalog of Australian Sphecidae).

Anacrucis ferruginea Rayment, 1955a:59, ♀. Holotype: ♀, Australia: New South Wales: Wauchope (BCRI), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— As *Sericophorus ferrugineus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:252 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus splendidus* is characterized by the following: middle clypeal section with elevation that is concave and glabrous ventrally (Fig. 191a-d, length of glabrous area about equal to midocellar width); tergum I with basolateral carina that extends to about midlength of spiracle, and the spiracle is not elevated. *Sericophorus tuberculatus* is similar, but unlike that species the frons of *splendidus* has no tooth, sternum I of most specimens is transversely ridged behind median carina (rather than punctate), and in most females the posterior mandibular margin is shallowly emarginate next to the notch rather than straight.

The male shares with *mandibularis* the unusual, double posteroventral mandibular tooth (Fig. 191d, f) and markedly convex ventrally flagellomeres III-V (Fig. 189e). Unlike *mandibularis*, however, *splendidus* has the posteroventral mandibular tooth rectangular or nearly so (rather than rounded), and the pronotum, scutellum, and metanotum all black (rather than partly yellow or red). The double posteroventral mandibular tooth also occurs in some males of *tuberculatus* in which, however, there is a prominent tooth below the frontal midheight (frons simple in *splendidus*).

Description.— Frontal punctures minute, less than one diameter apart; frontal line not

FIGURE 191. *Sericophorus splendidus* (Hacker and Cockerell): a – female clypeus in frontal view; b – male clypeus in frontal view; c – female clypeus in lateral oblique view; d – male clypeus in lateral oblique view (arrow indicates double posteroventral tooth); e – basal flagellomeres of male; f – male mandible (arrow indicates double posteroventral tooth).

extending above frontal midheight. Ocellocular distance equal to 0.8–0.9 × hindocellar width. Middle clypeal section elevated, ventral portion of elevation concave, glabrous, about as long as midocellar width; lamella entire or shallowly emarginate mesally, with two lateral teeth on each side in female, with one tooth in male (Fig. 191a-d). Pronotal collar minimally depressed mesally in some specimens. Propleuron slightly expanded posterolaterally. Scutal punctures minute, shallow, less than one diameter apart; scutal flange ending abruptly. Mesopleural punctures about two diam-

eters apart beneath scrobe. Propodeal dorsum finely punctate (interspaces shiny, finely microareolate), with short longitudinal ridges along anterior margin, with sharp median carina in shallow, glabrous, longitudinal depression; side punctate, almost unsculptured anteriorly; posterior surface punctate except for median sulcus. Forewing vein M diverging from M+Cu basad of, but close to, cu-a; second submarginal cell triangular or nearly so. Terga minutely punctate; horizontal area of tergum I with punctures that are several diameters apart; basolateral carina ending behind anterior margin of spiracle; apical depressions of tergum I impunctate in apical half; that of tergum II finely, sparsely punctate (punctures several diameters apart), impunctate near apical margin. Sternum I with basal swelling and in most specimens with transverse ridges behind it.

Setae silvery, concealing integument on lower frons, appressed on upper frons, postocellar area, and scutum; on propodeal dorsum suberect, oriented anterad (integument glabrous along midline, glabrous area broader apicomesally).

Frons with inconspicuous bluish luster in some specimens. Clypeus in female yellow (areas adjacent to middle section and to epistomal suture darkened), in male brownish to reddish brown (only apicomesally so in some specimens). Mandible yellow, darkened apically. Antenna in female reddish (scape yellow), in male reddish brown. Thorax and propodeum black, matt, pronotal lobe slightly reddish in many specimens. Gaster reddish brown in many specimens, all black in some. Femora black or brownish, female forefemur with large yellow spot. Tibiae and tarsi reddish brown. Clypeus is yellow in specimens with reddish brown gaster, but either yellow or black in those with black gaster.

♀.— Orbital fovea ill defined; posteroventral mandibular tooth slightly projecting anterad; posterior mandibular margin shallowly emarginate next to notch in most specimens, but simple in one female from Warrumbungle National Park, New South Wales. Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 1.1 × apical width; greatest length of flagellomere IX 1.0 × apical width, of flagellomere X 2.0 × basal width. Forebasitarsus with seven or eight rake spines. Setae of pygidial plate obscuring integument toward apex. Length 8–10 mm.

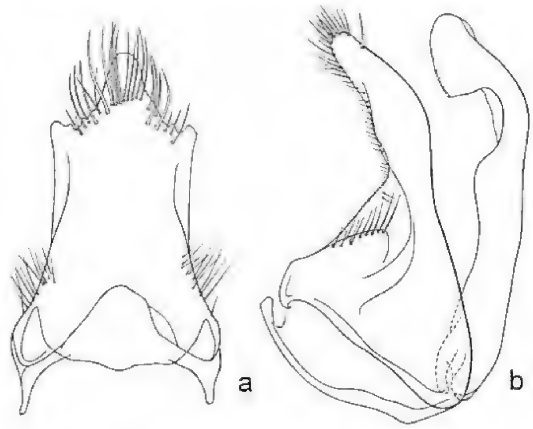

FIGURE 192. *Sericophorus splendidus* (Hacker and Cockerell): a – sternum VIII of male; b – male genitalia in lateral view.

♂.— Posteroventral mandibular tooth double, the lower tooth formed by extended posterior margin (Fig. 191d, f). Flagellomeres III-V markedly convex ventrally (Fig. 191e); dorsal length of flagellomeres I and II 1.0 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.9 × basal width. Forebasitarsus with five or six rake spines. Sternum VIII: Fig. 192a. Genitalia: Fig. 192b. Length 7.0–9.0 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 190).— New South Wales and Queensland.

RECORDS.— **AUSTRALIA**: **New South Wales**: Warrumbungle National Park, 17 Dec 1974 (1 ♀, UQIC, 17 Dec 2009 (2 ♀, 1 ♂, CAS); Harrington, 16 Mar 1959 (1 ♀, ANIC); Lismore, Jan 1933 (1 ♀, BCRI); Lorien Refuge 0.5 km SE Lansdowne near Taree, 20–29 Dec 1992 (1 ♀, CAS), 10–17 Jan 1993 (1 ♂, AMS); Millthorpe (1 ♀, BCRI, holotype of *Anacrucis cingulata*); Richmond River (1 ♀, BCRI); Wauchope, 1919 (1 ♀, BCRI, holotype of *Anacrucis ferruginea*). **Queensland**: Acacia Ridge near Brisbane, 29 Dec 1979 (1 ♀, USNM); 11 km NW Bald Hill at 13°44′S 143°20′E, 26 June–13 July 1989 (1 ♀, ANIC); Biggenden in

Bluff Range, 9–20 Dec 1972 (1 ♂, ANIC); Brisbane, 13 Mar 1918 (1 ♀, QMB, lectotype of *Zoyphium splendidum*); Brisbane, 3 Feb 1912, 6 Feb 1913, 12 Feb 1918, 14 Feb 1913, 13 Mar 1918, 14 Mar 1913, 28 Mar 1913 (7 ♀, QMB and USNM, paralectotypes of *Zoyphium splendidum*); Brisbane, 28 Jan 1913, 22 Apr 1913, 20 Oct 1912, 20 Nov 1913, 8 Dec 1915 and 19 Dec [year not indicated] (8 ♀, 1 ♂, BMNH, CAS, QMB, incorrectly labeled as paratypes, not part of original description); Brisbane, 15 Jan 1961, 28 Jan 1962, 20 Feb 1964, 5 Mar 1930, 10 Mar 1953, Mar 1964, 18 Aug 1957, 20 Nov 1960, 30 Nov 1955, 14 Dec 1959, Dec 1976 (8 ♀, 2 ♂, BMNH, CAS, QMB, UQIC); Buderim Mountains, 9 Dec 1962 (1 ♀, UQIC); Burleigh, 6 Nov 1937 (1 ♀, UQIC); Byfield, 19–22 Dec 1979 (1 ♀, UQIC); Calamvale near Brisbane, 1–10 Dec 1986 (1 ♂, USNM); Ipswich, 3 Dec 1965 (1 ♂, UQIC); Julatten: Kingfisher Park, 16 Nov 1996 (1 ♀, BMNH); Miva, Mar 1951 (1 ♂, UQIC); 9 km ENE Mount Tozer at 12°43′S 143°17′E, 5–10 July 1966 (1 ♀, ANIC); Mount Webb National Park at 15°04′S 145°07′E, 28–30 Sept 1980 (1 ♀, ANIC); North Queensland: no specific locality (3 ♂, BMNH); Point Lookout in New England National Park, 19–22 Dec 1979 and 15 Jan 1961 (2 ♀, UQIC); Redlynch, 1–10 Oct 1938 (3 ♂, BMNH); Wynnum, 25 Jan 1964 (1 ♂, UQIC).

Sericophorus striatulus (Rayment)

Figures 193–195.

Anacrucis striatula Rayment, 1955a:56, ♀. Holotype: ♀, Australia: New South Wales: Jamberoo (NMV), examined by O. Lomholdt and W. Pulawski.— As *Sericophorus striatulus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:254 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus striatulus* has the setae appressed on the upper frons and postocellar area; the antenna, thorax, propodeum, and gaster black (pygidial plate red in many females); the legs contrastingly reddish brown (forefemur darkened basally); no yellow markings; and the apical depression of tergum II impunctate (at least in apical half). *Sericophorus iridipennis* and *vicarius* are similar, but *striatulus* is larger (length 7.5–10.0 mm in female and 7.5 mm in male), the pronotal collar reaches the scutum level and is thick in dorsal view, the propodeal dorsum is finely ridged longitudinally (conspicuously so near base), and in the male the clypeal lamella has a well-defined lateral tooth and flagellomere X is about 2.0 × as long as its basal width. *Sericophorus iridipennis* and *vicarius* are smaller (length 4.8–5.8 mm in female and 4.0–4.3 mm in male), their pronotal collar does not reach the level of the scutum and is linear in dorsal view, the propodeal dorsum is ridged more or less obliquely, in the male the clypeal lamella is rounded laterally (with no tooth), and flagellomere X is about 1.3–1.6 × as long as its basal width.

Description.— Frons concave above antennal socket; frontal punctures shallow, ill defined, less than one diameter apart; frontal line a low carina ending near frons midheight. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.9 × hindocellar width. Pronotal collar somewhat swollen. Scutal and mesopleural punctures less than one diameter apart; scutal flange ending abruptly. Propodeal dorsum punctate and longitudinally ridged (ridges fine except conspicuous basally), with sharp median carina in shallow, glabrous, longitudinal depression, unsculptured apicomesally; side ridged dorsally, almost unsculptured anteriorly, punctate posteriorly; posterior surface finely ridged and punctate (except for median sulcus), unsculptured dorsomesally. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell conspicuously narrowed anteriorly, triangular in most specimens. Horizontal portion of tergum I with punctures averaging several diameters apart (except laterally), contrasting with much denser punctures of tergum II; interspaces almost unsculptured; apical depression of tergum II impunctate in at least apical half.

Setae short, appressed, not concealing integument on lower frons and clypeus in female, concealing in male, golden on upper frons in female, on lower frons and clypeus in male; appressed on upper frons, postocellar area, and scutum; subappressed oriented anterad on propodeal dorsum.

Head including antenna black, mandible black basally, reddish mesally, brown apically. Thorax and propodeum black, pronotal lobe somewhat reddish. Gaster black, tergum VI dark reddish brown in many females. Femora, tibiae, and tarsi reddish brown, forefemur darkened basally.

♀.— Orbital fovea wider than half ocellocular distance, matt, slightly impressed. Clypeal lamella slightly arcuate (Fig. 193a). Dorsal length of flagellomere I 1.2 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.9 × basal width, of flagellomere X 1.6 × basal width. Forebasitarsus with seven or eight rake spines. Setae of pygidial plate completely concealing integument in apical half. Length 7.5–10.0 mm.

♂.— Free margin of clypeal lamella slightly arcuate, almost straight, with one lateral tooth on each side (Fig. 193b). Antenna clavate (Fig. 193c); dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X 1.6–1.8 × basal width. Sternum VIII: Fig. 194. Genitalia: Fig. 194b. Length 7.5 mm.

Geographic distribution (Fig. 195).— New South Wales.

Records.— AUSTRALIA: New South Wales: 16 km East of Braidwood, 2 Mar 1972 (12 ♀, ANIC; 2 ♀, CAS); Brockelos Creek 16.5 km S Bermagui, 24–27 Feb 1974 (2 ♀, ANIC); Boonoo Boonoo area, 2700–3100 ft. via Amosfield, 9–10 Jan 1973 (1 ♀, UQIC); Colo Vale, 17 Jan 1957 (1 ♀, USNM); Darkes Forest, 20 Jan 1968 (1 ♀, BCRI); Eden, 27 Jan 1963 (1 ♀, ANIC); Epping, 26 Nov 1986 (1 ♀, AMS), 3 Dec 1986 (1 ♀, AMS), 24 Dec 1986 (2 ♀, AMS), 21 Jan 1987 (2 ♀, AMS), 28 Jan 1987 (1 ♀, AMS), 4 Feb 1987 (1 ♀, AMS), 11 Feb

FIGURE 193. *Sericophorus striatulus* (Rayment): a – female clypeus in frontal view; b – male clypeus in frontal view; c – apical flagellomeres of male.

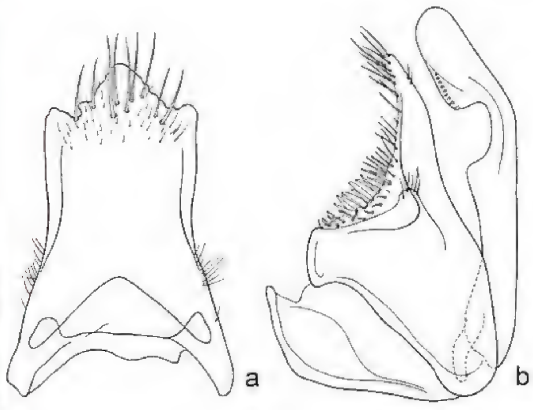

FIGURE 194. *Sericophorus striatulus* (Rayment): a – sternum VIII of male; b – male genitalia in lateral view.

1987 (2 ♀, AMS); Hornsby Heights (northern suburb of Sydney), 10–13 Feb 1964 (8 ♀, AMS), 10–13 Mar 1964 (1 ♀, AMS); Jamberoo, 9 Jan 1950 (1 ♀, 1 ♂, AMS; 1 ♀, NMV, holotype of *Anacrucis striatula*; 1 ♀, NMV, labeled paratype by Rayment, but not part of original description); Ku-ring-gai Chase National Park, 10–13 Mar 1964 (1 ♀, AMS; 1 ♀, CAS); Kurrajong Heights, 25 Jan 1935 (1 ♀, ANIC); Lisarow, 3 Mar 1963 (1 ♀, BCRI); Lorien Refuge 0.5 km SE Lansdowne near Taree, 13–21 Dec 1987 (1 ♂, AMS); Merimbula, 1 Jan 1965 (1 ♀, ANIC); Mount Keira, 13 Mar 1914 (1 ♀, BCRI, paratype of *Anacrucis striatula*) and 7 Mar 1967 (1 ♂, ANIC); Mount Wilson in Blue Mountains, 23 Feb 1979 (1 ♀, AMS); Mooney Mooney Creek near Gosford, 25 Nov 1975 (1 ♀, AMS); Putty Road at Tinda Creek, 17 Feb 1984 (1 ♀, AMS; 1 ♀, CAS); Sydney, 2 and 13 Apr 1909 (2 ♀, BISH), 9 Jan 1937 and 2 Feb 1940 (1 ♀, ANIC; 1 ♀ BMNH), 22 Nov 1960 (1 ♀, AMS); Sydney: Kangaroo Park Manly, 25 Dec 1986 (1 ♀, ANIC); Tenterfield, 9 Jan 1947 (1 ♀, AMS), Tooloom Plateau 14 km W Urbenville at 28°29′S 152°24′E, 14 Feb 1984 (1 ♂, CAS); Woronera River at Engadine, 5–11 Feb 1984 (2 ♀, AMS; 2 ♀, CAS).

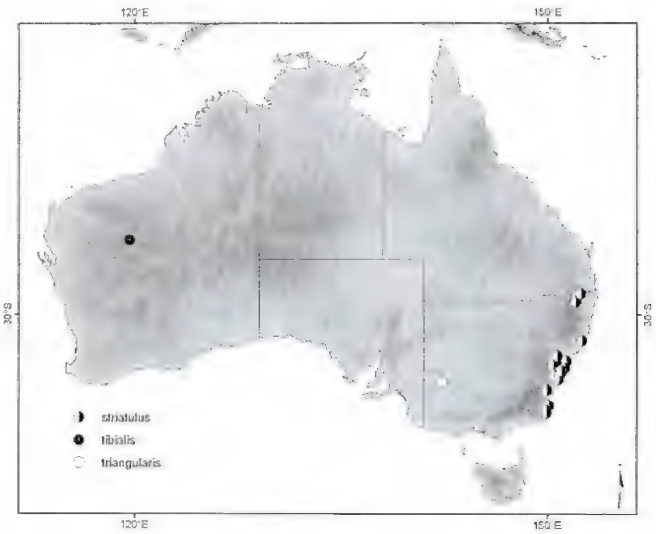

FIGURE 195. Collecting localities of *Sericophorus striatulus*, *tibialis*, and *triangularis*.

Sericophorus subalaris **Lomholdt, sp. nov.**
Figures 148, 196.

NAME DERIVATION.— *Subalaris*, Latin adjective meaning *under the wing*, with reference to the unusual subalar area.

RECOGNITION.— *Sericophorus subalaris*, from Papua New Guinea, shares with *ambonensis*, from Ambon Island, the angularly expanded subalar area (Fig. 196b) and the horizontal area of tergum I asetose or with a few microscopic, isolated setae (contrasting with basal area of tergum II). Subsidiary recognition features are: setae of upper frons and postocellar area appressed; clypeus, forecoxa, hindfemur, and gaster black, flagellum reddish brown ventrally; pronotum with a pair of pale yellow spots; propodeal dorsum, punctate (not ridged), in about anterior half with longitudinal carina that starts at posterior end of spiracle and separates it from the propodeal side. Unlike *ambonensis*, the posterior mandibular margin is straight between articulation and notch, rather than convex.

DESCRIPTION.— Frontal punctures minute, less than one diameter apart; frontal line varying from inconspicuous to well defined, extending or not extending into frons upper half. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.5 × hindocellar width. Scutal punctures averaging about one diameter apart; scutal flange ending abruptly. Mesopleural punctures minute, inconspicuous, several diameters apart; interspaces unsculptured below scrobe; subalar area angularly expanded (Fig. 196b), partly visible in dorsal view. Propodeal dorsum finely punctate, with several short, longitudinal ridges near base, with median carina, separated anterolaterally from side by longitudinal carina that extends posterad from posterior end of spiracle; side unsculptured anteriorly, with minute punctures posteriorly;

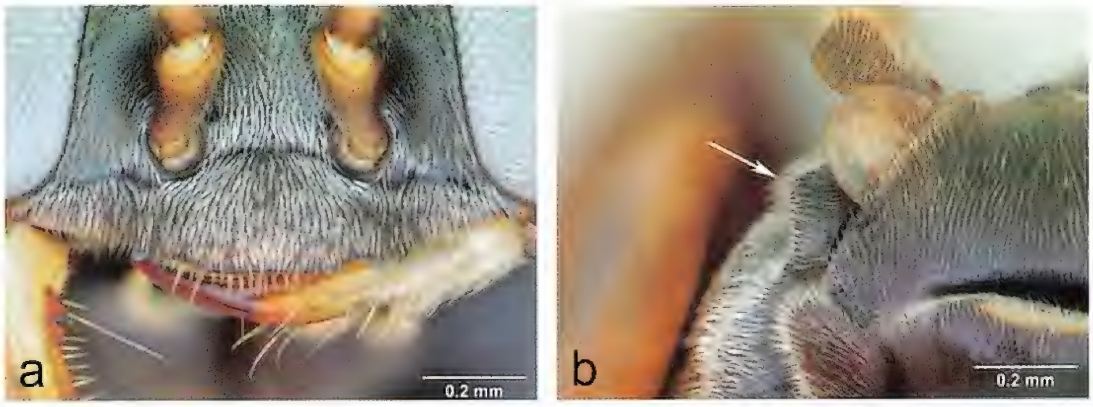

FIGURE 196. *Sericophorus subalaris* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – portion of pronotum, of scutum, and of upper mesopleuron (arrow indicates angularly expanded subalar area).

posterior surface transversely ridged in dorsal half (except for median sulcus), entirely so in specimen from Kokoda. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell narrowly open anteriorly or minimally petiolate. Tergum I aciculate, impunctate; terga II-V punctate except for impunctate apical depressions.

Setae of lower frons and clypeus silvery, largely obscuring integument; appressed on upper frons, postocellar area, and scutum, nearly so on propodeal dorsum, oriented anterad; horizontal area of tergum I asetose or with a few microscopic, isolated setae.

Head, thorax, propodeum, and gaster black except the following: scape and pedicel brown, flagellum brown ventrally; mandible pale yellow in basal two thirds, apex dark brown; pronotal collar with pair of narrow, pale yellow spots; pronotal lobe reddish apically. Femora dark brown (almost black), fore- and midfemora pale yellow apically on posterior surface. Foretibia yellow, midtibia yellow or brown, hindtibia brown; foretarsus yellow, mid- and hindtarsi brown.

♀.— Orbital fovea inconspicuous. Free margin of clypeal lobe almost straight mesally (Fig. 196a). Dorsal length of flagellomere I equal to apical width, of flagellomere II 1.3 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with five or six rake spines. Lateral carina of pygidial plate ill defined, setae partly obscuring integument. Length 5.2–6.0 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig 148).— Papua New Guinea.

RECORDS.— HOLOTYPE: ♀, **PAPUA NEW GUINEA: Morobe Province**: Buso, 8–10 Sept 1979, J.H. Martin (BMNH). PARATYPES: **PAPUA NEW GUINEA: Morobe Province**: 10 km W Bulolo, 5–25 Aug 1967, R. Straatman (1 ♀, BISH); NE Garaina, 13–15 Jan 1968, J. Sedlaček (1 ♀, CAS). **New Britain**: Rabaul, 10 June 1938, J.L. Froggatt (1 ♀, BMNH). **Northern Province**: Kokoda, Apr 1933, L.E. Cheesman (1 ♀, CAS).

***Sericophorus tibialis* Pulawski, sp. nov.**

Figures 195, 197.

NAME DERIVATION.— *Tibialis*, a Latin masculine and feminine adjective referring to tibia; with reference to the unusually thick hindtibia of this species.

RECOGNITION.— *Sericophorus tibialis* shares with *deserticola* a markedly enlarged hindtibia, clearly thicker than the hindfemur (Fig. 197f). Unlike that species, the clypeal lamella is emarginate laterally, with median section prominent and markedly narrower than the interantennal dis-

tance (Fig. 197d), the foretarsal rake is not elongate (longest spine of the forebasitarsus is no longer than the basitarsus width, rather than markedly longer), and the pygidial plate is densely punctate (punctures at center less than one diameter apart, rather than more than one diameter apart). Subsidiary recognition features are: antennal socket separated from clypeal free margin by about socket width (Fig. 197a, d), ocellocular distance unusually large, equal to 1.6 × hindocellar width (Fig. 197b), orbital fovea well defined, posteroventral mandibular notch shallow, unusually long (Fig. 197e), and tooth on mandibular inner margin located beyond mandibular midlength.

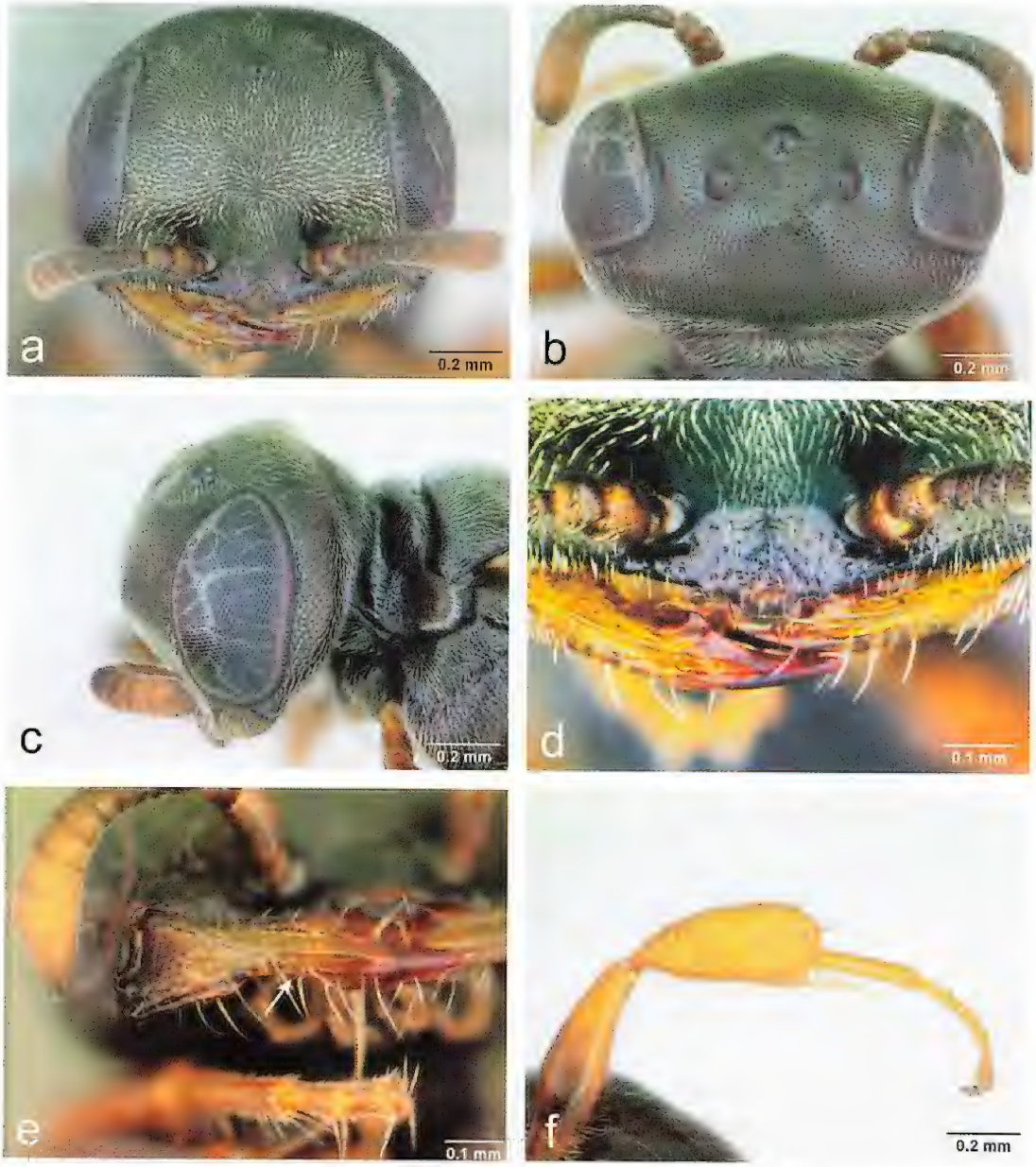

FIGURE 197. *Sericophorus tibialis* Pulawski, sp. nov.: a – female head in frontal view; b – female head in dorsal view; c – female head in lateral view; d – female clypeus in frontal view; e – female mandible (arrow indicates mandibular notch); f – female hindfemur, hindtibia, and hindtarsus.

Description (based on holotype only).— Head wide (Fig. 197a), length to width ratio about 1.0:1.3 (length measured from midpoint of clypeal free margin to top of vertex). Frons markedly convex (Fig. 197c); frontal punctures about one diameter apart; frontal line absent. Gena swollen in dorsal view (Fig. 197b). Antennal socket separated from clypeal free margin by about socket width (Fig. 197a, d). Ocellocular distance equal to 1.6 × hindocellar width (Fig. 197b). Posteroventral mandibular notch shallow, unusually long (Fig. 197e), tooth on mandibular inner margin located beyond mandibular midlength. Scutal punctures well defined, on disk averaging about one diameter apart, interspaces almost unsculptured, shiny; scutal flange gradually narrowing posterad. Mesopleural punctures about two diameters apart beneath scrobe. Propodeal dorsum finely, irregularly ridged, with short, larger, longitudinal ridges basally, with shallow, median impression (impression glabrous) that contains longitudinal carina; side microsculptured, minutely ridged (ridges evanescent anteriorly); posterior surface minutely, sparsely punctate (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly. Hindtibia markedly enlarged, flattened laterally, clearly thicker than hindfemur (Fig. 197f), without spines on outer surface (only with setae), with small tubercle on inner surface. Tergum I concave anteriorly, punctures of horizontal area about 2–3 diameters apart; apical depression impunctate; apical depression of tergum II impunctate posteriorly. Sternum I with double median ridge basally.

Setae of lower frons and clypeus silvery, not obscuring integument; erect on upper frons, as long as 0.4 × midocellar width on interocellar area, appressed on postocellar area and scutum; appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except mandible yellowish basally, dark brown apically, and flagellum brown in apical half. Forefemur black, brown apically; midfemur brown dorsally, black ventrally; hindfemur brown, black basally; tibiae, and tarsi brown.

♀.— Orbital fovea well defined, its width about 0.4 × ocellocular distance. Clypeal lamella emarginate laterally, flanked on each side by small tooth (Fig. 197d); distance between tooth and adjacent orbit almost 2.5 × distance between teeth. Dorsal length of flagellomere I about 1.0 × apical width, of flagellomere II about 0.6 × apical width; greatest length of flagellomere IX 0.5 × apical width, of flagellomere X 1.1 × basal width. Forebasitarsus with six rake spines. Setae of pygidial plate not concealing integument. Length 2.6 mm.

♂.— Unknown.

Geographic distribution (Fig. 195).— Known from one locality in Western Australia.

Records.— Holotype: ♀, **AUSTRALIA: Western Australia**: 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003, F.D. Parker and M.E. Irwin (ANIC).

***Sericophorus triangularis* Lomholdt, sp. nov.**

Figures 195, 198.

Name derivation.— *Triangularis*, Latin for triangular; with reference to the shape of median sulcus of the propodeal dorsum.

Recognition.— *Sericophorus triangularis* has the upper frons and postocellar area covered with erect setae, the anterior declivity of tergum I concave, a black frons, thorax, propodeum, and gaster (gastral apex reddish brown), the ocellocular distance equal to 0.7 × hindocellar width, and the propodeal side separated from the posterior surface by a series of oblique ridges that are crossed by a longitudinal, zigzagging ridge. It differs from similar species (*littoralis*, *nigrescens*, *sanguineus*) in that the pronotal collar does not attain the level of the scutum, the median sulcus of the

propodeal dorsum broadens anterad (Fig. 198c), and the dark brown foretarsomeres I-IV contrast with the reddish brown foretibia. The markedly arcuate clypeal lamella with a prominent lateral tooth is a subsidiary recognition feature (Fig. 198a).

DESCRIPTION.— Frons swollen near center; frontal punctures averaging about one diameter apart, markedly more than that near top of swelling; frontal line well defined, reaching midocellus; interocellar area convex adjacent to hindocellus, concave mesally. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.7 × hindocellar width. Clypeus shallowly concave mesoventrally; lamella conspicuously arcuate, lateral tooth conspicuously prominent (Fig. 198a). Pronotal collar not attaining level of scutum (Fig. 198b). Scutal punctures averaging about one diameter apart (several punctures two or three diameters apart); scutal flange gradually narrowing posterad. Mesopleural punctures many diameters apart near center (Fig. 198b). Propodeal dorsum longitudinally ridged laterally, punctate admesally, with short, longitudinal ridges near base, and broadly triangular, glabrous impression mesally; impression containing longitudinal carina and several arcuate ridges (Fig. 198c); side almost unsculptured, with minute, sparse punctures (except anteriorly), separated from posterior surface by series of oblique ridges intersected by longitudinal, zigzagging ridge; posterior surface transversely ridged (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal cell open anteriorly. Horizontal area of tergum I with minute punctures that are several diameters apart (about one diameter apart preapically); anterior declivity markedly concave; apical depressions of terga I and II narrowly impunctate along hindmargins.

FIGURE 198. *Sericophorus triangularis* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – female head and anterior portion of thorax in lateral view (arrow indicates pronotal collar not attaining level of scutum); c – propodeal dorsum in dorsal view.

Setae silvery, reflective, almost completely concealing integument on lower frons along orbit and on clypeus (except mesoventrally); erect on upper frons and postocellar area, about as long as 0.6 × midocellar width on interocellar area; suberect, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following: mandible pale yellow (dark

brown apically); scape and pedicel dark brown to blackish, flagellum reddish brown (apical half of apical flagellomere darkened); terga V and VI bright reddish brown. Femora black except reddish brown apically; tibiae reddish brown; foretarsus dark brown dorsally (except apical tarsomere), mid- and hindtarsi yellowish brown.

♀.— Orbital fovea ill defined. Clypeal lamella slightly arcuate, lateral tooth markedly projecting anterolaterad (Fig. 198a). Dorsal length of flagellomere I about 1.1 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX equal to 0.7 × apical width, of flagellomere X 1.3 × basal width. Forebasitarsus with six or seven rake spines. Setae of pygidial plate not concealing integument. Length 5.9–6.1 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 195).— Known from one locality in Victoria.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Victoria,** 11 km N Kiamal (spelled Kiamil on label) at 34°54'S 142°18'E, 25 Oct 1983, I.D. Naumann and J.C. Cardale (ANIC). PARATYPE: same data as holotype (1 ♀, CAS).

Sericophorus trichocephalus Pulawski, sp. nov.

Figures 199–201.

NAME DERIVATION.— *Trichocephalus*, a Neolatin masculine adjective, is derived from two Greek words: θριξ (genitive: τριχος), a hair, and κεφαλη, a head; with reference to a markedly setose lower frons in the female of this species.

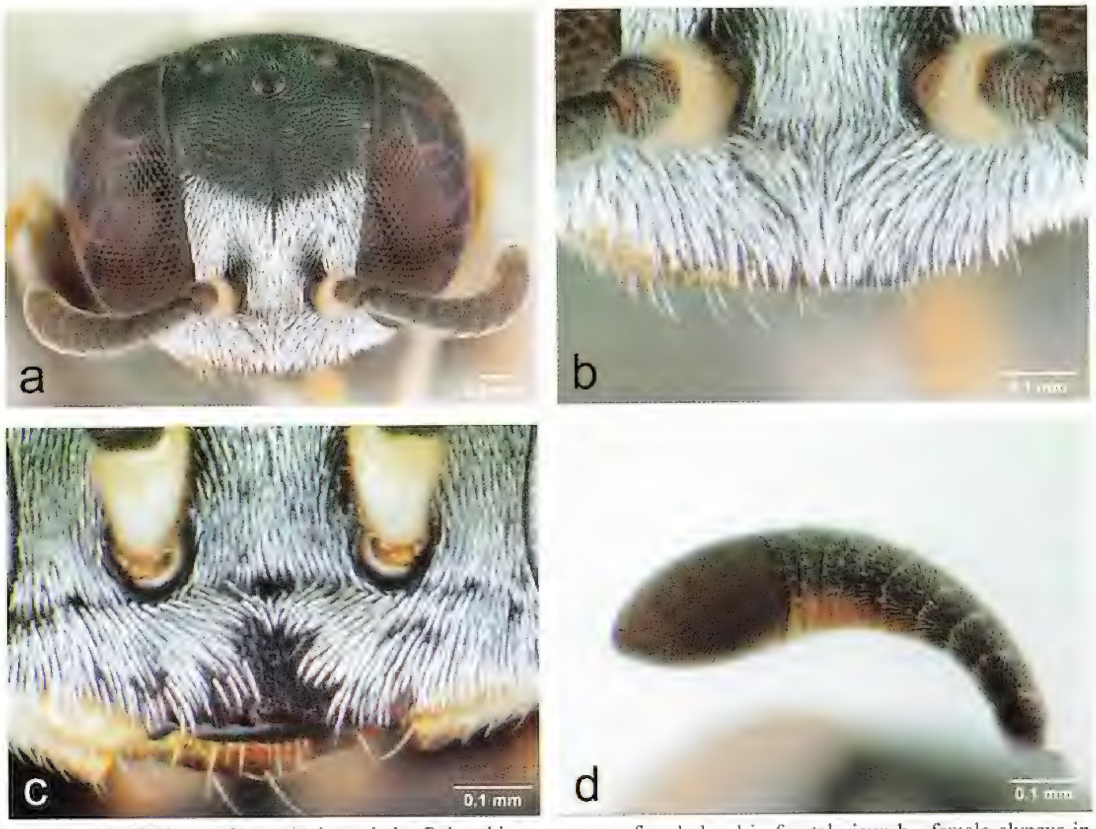

FIGURE 199. *Sericophorus trichocephalus* Pulawski, sp. nov.: a – female head in frontal view; b – female clypeus in frontal view; c – male clypeus in frontal view; d – male flagellum.

Recognition.— *Sericophorus trichocephalus* is a mainly black species (only mandible, scape, pronotal lobe, tibiae and tarsi are yellow), with the setae appressed on the frons, postocellar area, and scutum. It is mainly characterized by the lack of specializations found in many other species: the frons is densely punctate, the clypeus non-emarginate and without elevation, the glossa is short (shorter than scape), the mandibular posterior margin is straight between the base and the notch, the pronotal collar is not emarginate and reaches the level of the scutum, the propleuron is not expanded posterolaterally, the axilla is not expanded laterally, the subalar area is not expanded, the propodeal dorsum is finely punctate (except basally and mesally) and without sublateral carina, three submarginal cells are present, the forecoxa is largely black, the hindtibia is not swollen, the basolateral carina of tergum I ends well before the anterior margin of the spiracle, the apical depressions of terga I and II are impunctate, sternum I has no projection, and female tergum VI is densely punctate. The species closely resembles *riparius*, but differs in having the inner eye orbits slightly diverging dorsad (Fig. 199a) rather than slightly converging, the clypeus black (rather than yellow), and in the female the setae of the lower frons concealing the integument and markedly contrasting with these of upper frons (Fig. 199a) rather than not contrasting. A subsidiary recognition feature is the presence, in the male, of a tuft of erect setae in each posterolateral corner of sternum VI.

Description.— Inner orbits slightly diverging dorsad (Fig. 199a). Frontal punctures minute, ill defined, less than one diameter apart. Frontal line faint, attaining midocellus. Scapal basin present, sparsely setose. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.9–1.1 × hindocellar width. Most punctures on scutal disk about two diameters apart; scutal flange ending abruptly. Mesopleural punctures, near center, more than one diameter apart. Propodeal dorsum with conspicuous, short ridges along free margin, with shallow, median, glabrous impression that contain median carina and finer oblique carinae emerging from it, remaining surface punctate; side unsculptured or aciculate anteriorly, with minute, mostly sparse punctures posteriorly; posterior surface punctate, ridged ventrally (except mesally), mesodorsal area ridged. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell triangular or narrowly opened. Tergum I slightly concave anteriorly, punctures of horizontal area averaging between one and two diameters apart; apical depression impunctate in posterior half or so; apical depression of tergum II impunctate.

Setae of lower frons and clypeus silvery, fully obscuring integument in female and visibly contrasting with those of upper frons, obscuring integument only on clypeus in male; appressed on upper frons, postocellar area, and scutum; on interocellar area suberect, about as long as 0.2–0.3 × midocellar width; appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except scape, mandible, and pronotal lobe posteriorly are pale yellow (mandible dark brown apically) and flagellomeres V-IV brown ventrally. Femora black, fore- and midfemora pale yellow apically; tibiae pale yellow, mid- and hind-tibiae darkened ventrally; tarsi pale yellow.

♀.— Orbital fovea ill defined, wider than half ocellocular distance. Free margin of clypeal lobe straight (Fig. 199b). Dorsal length

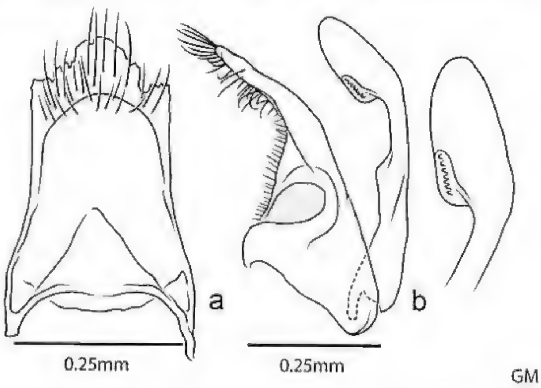

Figure 200. *Sericophorus trichocephalus* Pulawski, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view, with outline of penis valve.

of flagellomere I 1.0 × apical width, of flagellomere II 0.9 × apical width; greatest length of flagellomere IX 0.8 × apical width; greatest length of flagellomere X 2.0 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate largely concealing integument. Length 4.5–5.8 mm.

♂.— Free margin of clypeal lobe straight, with one lateral tooth (Fig. 199c). Flagellum clavate (Fig. 199d); dorsal length of flagellomere I 1.0 × width, of flagellomere II 0.8 × apical width; greatest length of flagellomere IX 0.5 × apical width, of flagellomere X 1.6 × basal width. Forebasitarsus with five rake spines. Sternum VI with tuft of erect setae in posterolateral corner (setal length no less than midocellar width). Sternum VIII: Fig. 200a. Genitalia: Fig. 200b. Length 4.8–6.0 mm.

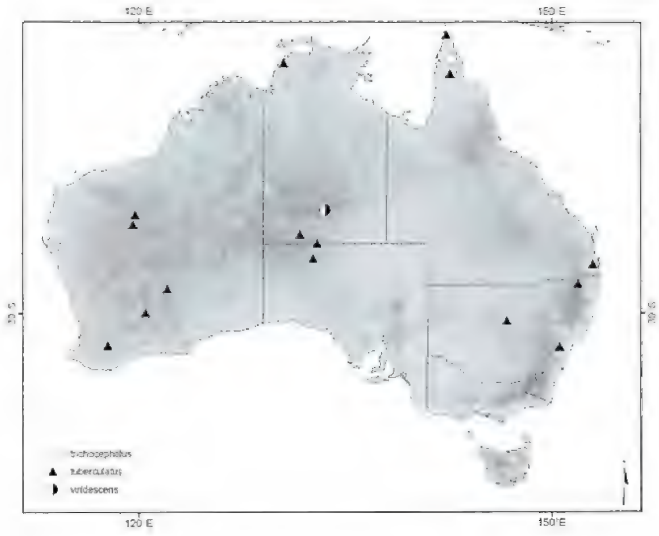

FIGURE 201. Collecting localities of *Sericophorus trichocephalus*, *tuberculatus*, and *viridescens*.

GEOGRAPHIC DISTRIBUTION (Fig. 201).— Northern Queensland.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Queensland**: Hann River at 15°11′S 143°52′E, 18 Dec 1993–14 Jan 1994, P. Zborowski and E.D. Edwards (ANIC). PARATYPES: **AUSTRALIA: Queensland**: same data as holotype (2 ♀, ANIC; 2 ♀, CAS); same locality but 14 Jan–21 Feb 1994, P. Zborowski and G. Turner (1 ♂, ANIC); 4 km NE Batavia at 13°39′S 142°42′E, 11 Dec 1992–17 Jan 1993, P. Zborowski and E.D. Edwards (1 ♀, ANIC); 2 km N Rokeby at 13°39′S 142°40′E, 16 Nov–17 Dec 1993, P. Zborowski (1 ♂, ANIC); same locality but 17 Dec 1993–17 Jan 1994, P. Zborowski and M. Shaw (1 ♂, CAS).

Sericophorus tuberculatus (Turner)

Figures 201–204.

Zoyphium tuberculatum Turner, 1936:543, ♀. Holotype: ♀, Western Australia: Dedari 40 mi. W Coolgardie (BMNH), examined by O. Lomholdt.— As *Sericophorus tuberculatus*: Bohart and Menke, 1976:303 (new combination, listed); Cardale, 1985:254 (in catalog of Australian Sphecidae).

RECOGNITION.— *Sericophorus tuberculatus* has two unique characters: a prominent tooth below the frontal midheight (Fig. 202a, b) and sternum I that has a basomedian ridge bifurcating near midlength, and is concave and punctate behind bifurcation. Subsidiary recognition features include: apical flagellomere elongate (length in female 1.7 × basal width, in male 1.7–1.9 × basal width, Fig. 203b), thorax and propodeum black, gaster, legs and antennae reddish brown, male flagellomere III with tooth-like, apical swelling ventrally.

DESCRIPTION.— Frontal punctures minute, less than one diameter apart; frontal line expanded into conspicuous tooth below frontal midheight (Fig. 202a, b). Midocellus in wide depression. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.6 × hindocellar width. Postocellar area with punctures markedly larger than those of frons, with low, median swelling just behind hindocelli. Apical flagellomere about as long as four previous combined, its apex slightly curved (Fig. 203b). Propleuron with anteriorly orient-

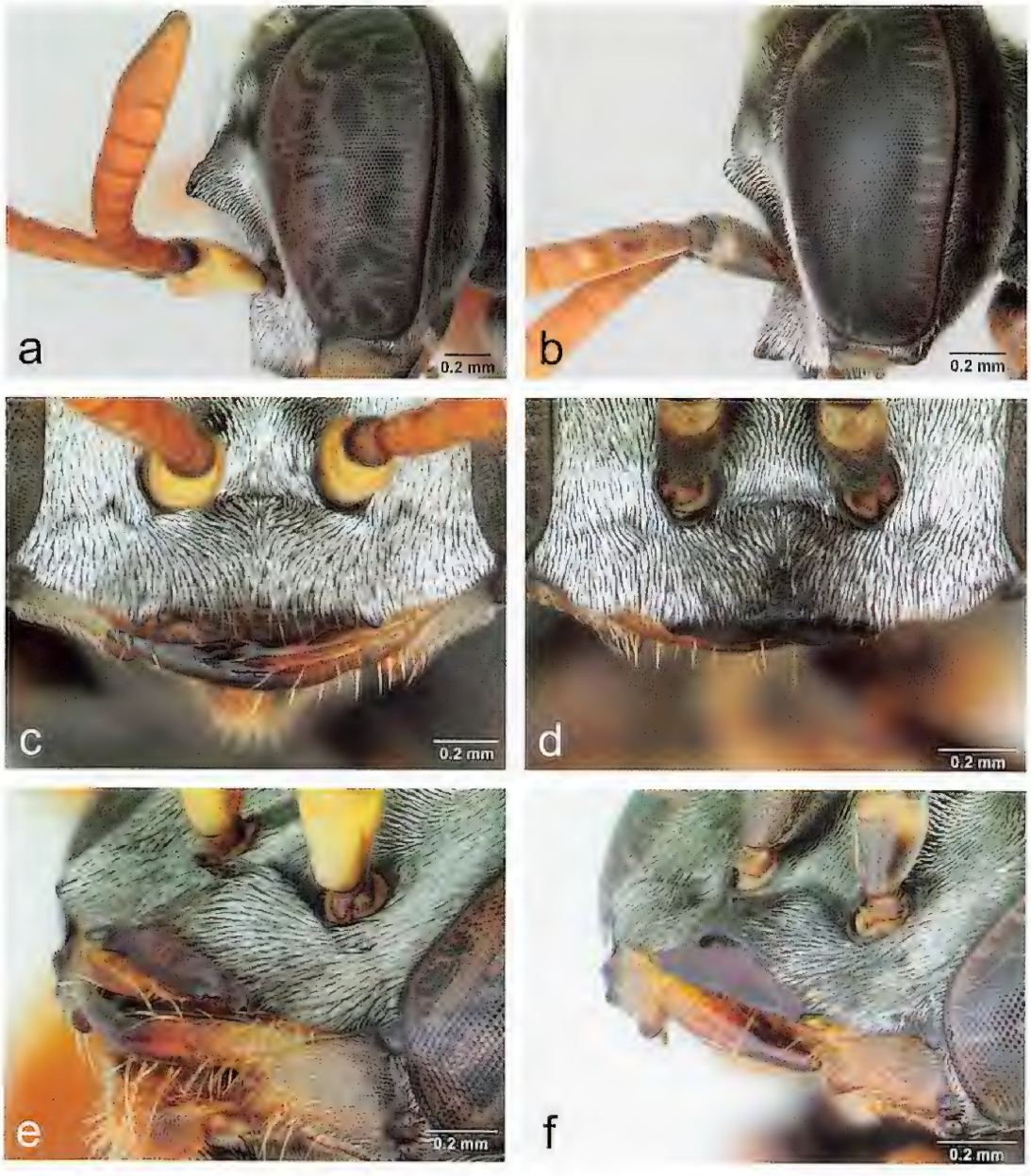

FIGURE 202. *Sericophorus tuberculatus* (Turner): a – female head in lateral view; b – male head in lateral view; c – female clypeus in frontal view; d – male clypeus in frontal view; e – female clypeus in oblique lateral view; f – male clypeus in oblique lateral view.

ed posterolateral swelling. Scutal punctures less than one diameter apart; scutal flange ending abruptly. Mesopleural punctures one diameter or more apart below scrobe, interspaces shiny (microsculpture ill defined). Propodeal dorsum and side punctate (side unsculptured anteriorly), interspaces shiny, not or only slightly microareolate; dorsum with short ridges emerging from anterior margin and with sharp median carina in shallow, glabrous depression; posterior surface largely ridged except for median sulcus. Forewing vein M diverging from M + Cu basad of, but close

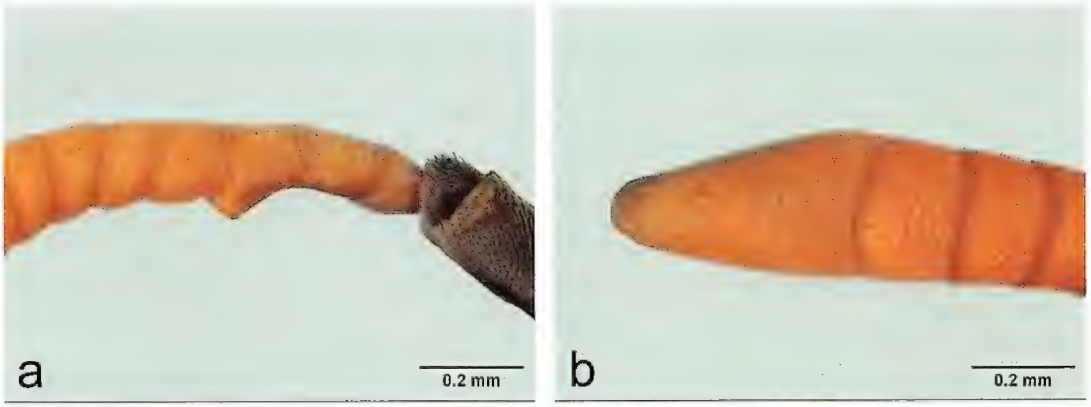

FIGURE 203. *Sericophorus tuberculatus* (Turner): a – basal flagellomeres of male; b – apical flagellomeres of male.

to, cu-a, interstitial with cu-a in specimen from Nyngan; second submarginal cell triangular. Terga shiny, minutely punctate (but apical depressions of terga I and II impunctate near hindmargin); tergum I with punctures several diameters apart on horizontal area; basolateral carina ending behind or at level of anterior margin of spiracle; spiracle projecting into minute, short spine posteriorly. Sternum I basally with median ridge that bifurcates near sternal midlength, area behind bifurcation concave, punctate.

Setae of lower frons and clypeus silvery, entirely concealing integument; appressed on upper frons, postocellar area, and scutum (scutal setae dark coppery); inclined anterad on propodeal dorsum.

Head black except the following: clypeus narrowly reddish brown along lamella in females from Western Australia, mandible yellow or black basally, reddish brown mesally, black or nearly so apically; scape almost all yellow, pedicel dark reddish brown to black; flagellum bright yellowish brown. Thorax and propodeum all black in most specimens, but pronotal collar with pair of lateral, effaced yellow spots in specimen from Nyngan area, New South Wales. Femora black basally, reddish brown mesally, yellow apically (black area larger in specimens from New South Wales and Queensland than in those from Western Australia); foretibia red, with yellow posterior surface; mid- and hindtibiae red, yellow dorsally; tarsi reddish brown. Gaster reddish brown.

♀.— Middle clypeal section in most specimens elevated, with narrow, glabrous, vertical declivity between elevation and free margin (Fig. 202c, e), but elevation and declivity reduced in some specimens and practically absent in specimens from Dumbleyung and Yundamindra, Western Australia. Orbital fovea about as wide as half ocellocular distance. Dorsal length of flagello-mere I 1.1 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.7 × basal width. Forebasitarsus with six or seven rake spines. Setae of pygidial plate not concealing integument except posteriorly. Length 7.5–9.0 mm.

♂.— Middle clypeal section elevated, elevation prominent mesally in specimen from

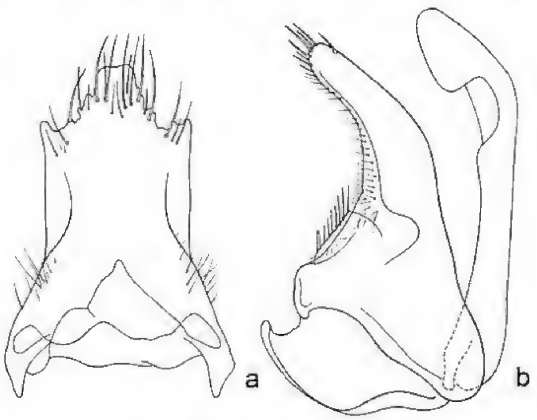

FIGURE 204. *Sericophorus tuberculatus* (Turner): a – sternum VIII of male; b – male genitalia in lateral view.

Brisbane, Queensland, with glabrous, concave declivity between elevation and free margin (Fig. 202d, f); lamella emarginate mesally. Flagellomere II flattened ventrally, III with ventral tooth-like swelling apically (Fig. 203a); dorsal length of flagellomere I 1.2 × apical width, of flagellomere II 1.1 × apical width; greatest length of flagellomere IX 0.6 × apical width, of flagellomere X 1.7–1.9 × basal width. Posteroventral mandibular tooth double in larger specimens, simple in small ones. Forecoxa with yellow spot. Forebasitarsus with five rake spines. Sternum VIII: Fig. 2204a. Genitalia: Fig. 204b. Length 5.0–7.0 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 201).— Australia except Victoria and Tasmania.

RECORDS.— **AUSTRALIA**: **New South Wales**: 6 and 7 km NE Bilpin in Blue Mountains, 8 Apr 1981 and 25 Apr 1982 (2 ♀, AMS); 25 miles W Nyngan, 3 Nov 1969 (1 ♂, MCZ). **Northern Territory**: Curtin Springs Homestead 85 km E Yulara at 25°20′S 131°45′E, 16 Oct 1971 (1 ♀, CAS); near Finniss River at 12°57′S 130°33′E (1 ♀, NTM); Victory Downs at 25°59′S 132°58.5′S, 15 Oct 1971 (1 ♂, CAS). **Queensland**: Bald Mountain via Emu Vale at 28°54′S 151°55′E, 17–22 May 1969 (1 ♀, CAS); Bamaga, 18 Feb 1984 (1 ♂, AEI); Brisbane, 8 Feb 1916 (BMNH, 1 ♂, labeled *Zoyphium splendidum* Hacker and Cockerell, Cotype), 7 Apr 1914 (1 ♀, QMB, placed under *splendidus* and labeled "Paratype"), 3 Mar 1914 (2 ♂, QMB, labeled "Allotype" and "Paratype", respectively, placed under *splendidus*); 2 km N Rokeby at 13°39′S 142°40′E, 17 Dec 1993–17 Jan 1994 (1 ♀, ANIC); **South Australia**: Everard Park Station 4 miles South of Maynard's Bore, 5 Nov 1970 (2 ♂, SAM). **Western Australia**: Dedari 40 mi. W Coolgardie, 11–12 Jan 1936 (1 ♀, BMNH, holotype of *tuberculatus*); Dumbleyung, 27 Feb 1965 (1 ♀, CAS); 70 km S Great Northern Highway at 23°54.3′S 119°45.4′E, 24 Apr–6 May 2003 (1 ♀, ANIC); 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003 (1 ♀, USU); Yundamindra Homestead at 29°15′S 121°06′E, 16 Mar 1979 (1 ♀, WAMP).

Sericophorus vicarius Lomholdt, sp. nov.

Figures 205–207.

NAME DERIVATION.— *Vicarius*, Latin masculine adjective meaning *who replaces, replacing*; an allusion to this species replacing the Tasmanian *iridipennis* on the Australian continent.

RECOGNITION.— *Sericophorus vicarius* has the setae appressed on the upper frons and postocellar area, the thorax, propodeum, forecoxa, and gaster black (pronotal lobe yellow in some specimens), the femora, tibiae, and tarsi reddish brown to yellow, the pronotal collar not reaching the level of the scutum (Fig. 205c), its dorsum is linear in dorsal view, the propodeal dorsum finely, obliquely ridged, without sublateral carina, and the apical depression of tergum II largely impunctate. Additional characters include: clypeus without elevation, axilla not expanded, and frons densely punctate. In the male, the clypeal lamella is angulate laterally. *S. iridipennis* is similar, but in *vicarius* the antenna is largely yellowish brown or reddish brown and in the female the clypeal lamella is slightly arcuate and in most specimens the clypeus is all or partly yellow (but black in some). In *iridipennis*, the antenna is black and in the female the clypeus is black, with the lamella straight. In most *vicarius*, the forecoxa is black, but it is largely yellowish in a female from Mossman, Queensland. Unlike *punctum* (whose female is unknown), the male of *vicarius* has a nonprominent lateral corner of the clypeal lamella (rather than prominent), and the head width is slightly less than 1.2 × length, length measured from midpoint of clypeal free margin to top of vertex (rather than 1.3 ×).

DESCRIPTION.— Frontal punctures minute, inconspicuous, less than one diameter apart. Frontal line ill defined, reaching midocellus in most specimens, but not extending above frontal midheight in some. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.7–0.8 × hindocellar width. Postocellar area slightly convex adjacent to hindocellus, slightly concave mesally. Pronotal collar linear, not reaching level of scutum (Fig. 205c). Scutal punctures about one diameter apart; scutal flange ending abruptly. Meso-

pleural punctures about two to three diameters apart near center; interspaces unsculptured. Propodeal dorsum obliquely ridged (ridges conspicuous basally, gradually finer toward apex), punctate between ridges, with median carina in shallow, glabrous depression, with unsculptured apicomedian area; side minutely ridged, practically unsculptured anteriorly; posterior surface finely punctate or finely ridged (except for median sulcus). Forewing vein M diverging from M+Cu basad of but close to cu-a, interstitial with cu-a in some specimens; second submarginal cell triangular or narrowly open anteriorly. Horizontal area of tergum I with punctures that are several diameters apart; apical depression practically impunctate; anterior declivity concave; apical depression of tergum II impunctate. Sternum I with double median ridge basally.

Setae of frons and clypeus silvery, relatively sparse, not obscuring integument; appressed on upper frons, postocellar area, and scutum; nearly appressed, oriented anterad on propodeal dorsum.

Clypeus with narrow reddish brown or yellow zone adjacent to lamella in most specimens from New South Wales and Queensland (also lateral clypeal section partly reddish brown in some), but largely reddish brown or yellow in some specimens from Queensland and many from Western Australia, and all yellow is some from Western Australia; antenna yellowish brown or reddish brown (apical flagellomeres dark brown dorsally); mandible yellow, brown apically. Thorax, propodeum, and gaster black except the pronotal lobe is pale yellow posteri-

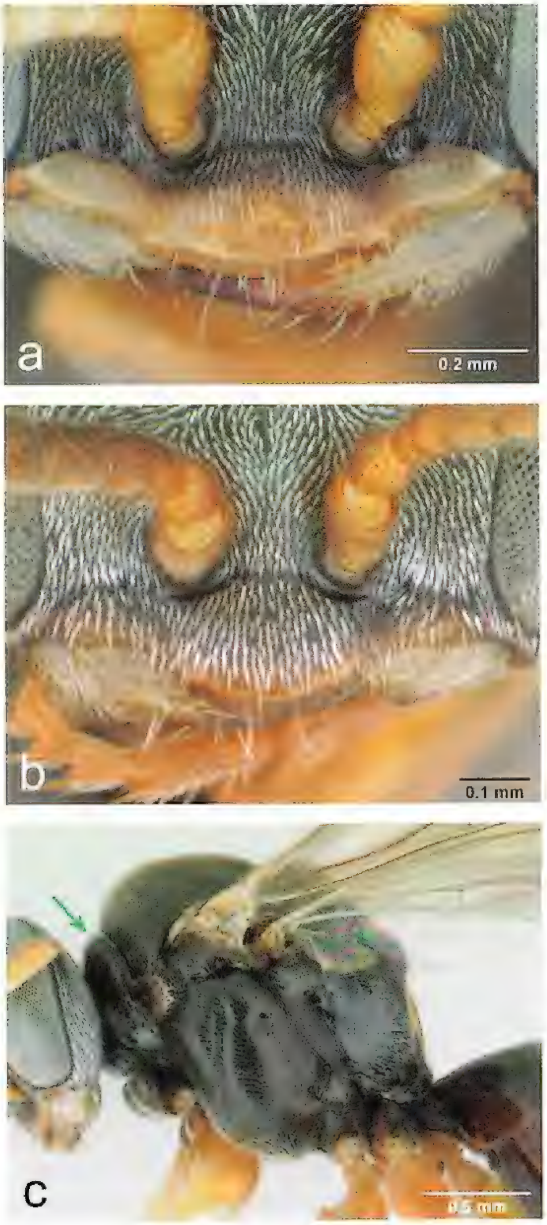

FIGURE 205. *Sericophorus vicarius* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – male clypeus in frontal view; c – female thorax and propodeum in lateral view (arrow indicates pronotal collar not attaining level of scutum).

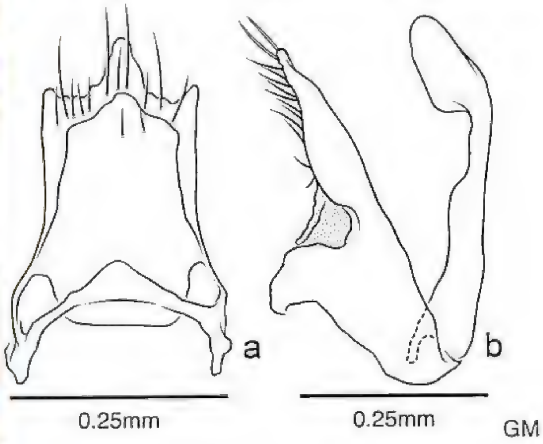

FIGURE 206. *Sericophorus vicarius* Lomholdt, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view.

orly in many specimen and female tergum VI and apical area of tergum V reddish brown. Forecoxa black in most specimens, but largely yellowish in female from Mossman, Queensland. Femora, tibiae, and tarsi reddish brown to yellow.

♀.— Orbital fovea evanescent, ill defined. Clypeal lamella arcuate (Fig. 205a). Dorsal length of flagellomeres I and II 1.0–1.1 × apical width; greatest length of flagellomere IX 0.8 × apical width, of flagellomere X 1.5–1.6 × basal width. Forebasitarsus with five or six rake spines. Setae of pygidial plate concealing integument apically. Length 4.0–5.3 mm.

♂.— Clypeal lamella angulate laterally (Fig. 205b). Dorsal length of flagellomere I 1.0 × apical width, of flagellomere II 0.8–1.0 × apical width; greatest length of flagellomere IX 0.7–0.8 × apical width, of flagellomere X 1.3–1.6 × basal width. Forebasitarsus with five or six rake spines. Sternum VII: Fig. 206a. Genitalia: Fig. 206b. Length 3.0–3.8 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 207).— All Australia except Tasmania.

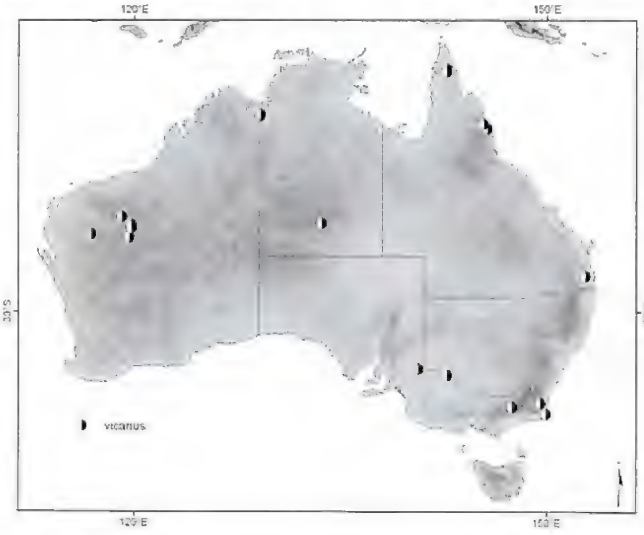

FIGURE 207. Collecting localities of *Sericophorus vicarius*.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA**: **New South Wales**: Euston, 10 Apr 1982, W.D. Oldham (ANIC). **PARATYPES**: **New South Wales**: Brown Mountain, 28–31 Jan., no year or collector, but probably H.K. Townes (1 ♀, AEI); Nadgee [Nature] Reserve 5 km N Newton, 13 Jan 1987, E.A. Sugaen (1 ♀, USNM). **Northern Territory**: 32 km WNW Alice Springs at 23°36′S 133°35′E, 8 Oct 1978, J.C. Cardale (1 ♂, ANIC); Keep River National Park, M.E. Irwin, F.D. Parker, and C. Lambkin, at 15°44′17″S 120°06′55″E, 7–8 June 2001 (1 ♀, ANIC; 1 ♀, CAS) and 15°54′55″S 129°04′11″E, 3–8 June 2001 (1 ♀, ANIC). **Queensland**: 4 km NE Batavia Downs at 12°30′S 142°42′E, 11 Dec 1992–17 Jan 1993, P. Zborowski (1 ♀, ANIC; 1 ♀, CAS), 17 Feb–8 Mar 1993, I. Cunningham (1 ♀, ANIC), and 4 Apr–23 May 1993, P. Zborowski and A. Roach (1 ♀, ANIC); 7 km S Batavia Downs at 12°43′S 142°42′E, 14 Feb–8 Mar 1993, I. Cunningham (3 ♀, ANIC); Kuranda, 17–24 Feb 1984, L. Masner (1 ♀, AEI) and 22 Dec 1987, T.W. Davies (1 ♀, CAS); Mossman, Jan [no day, year, or collector] (1 ♀, CAS); Mount Nebo, 20 Mar [no year or collector] (1 ♀, AEI). **South Australia**: 14 km WNW Renmark at 34°07′S 140°37′E, 28 Mar–2 May 1995, K.R. Pullen (1 ♀, CAS). **Victoria**: Mitta Mitta Creek 25 km NNW Omeo, 28 Feb 1980, I.D. Naumann and J.C. Cardale (1 ♀, ANIC). **Western Australia**: Great Northern Highway 82 km S junction Karjini Drive at 23°07.3′S 119°05.5′E, 6–17 May 2003, F.D. Parker & M.E. Irwin (1 ♀, CAS); 70 km S Great Northern Highway at 23°54.3′S 119°45.4′E, 24 Apr–6 May 2003, F.D. Parker & M.E. Irwin (2 ♀, ANIC); Mount Augustus National Park at 24°21.7′S 116°50.7′E, 25 Apr–7 May 2003, F.D. Parker & M.E. Irwin (1 ♀, ANIC); 45 km S Newman at 23°42.4′S 119°44.3′E, 24 Apr–6 May 2003, M.E. Irwin and F.D. Parker (1 ♀, CAS; 2 ♀, USU); 74 km S Newman at 23°56.0′S 119°46.0′E, 6–28 May 2003, F.D. Parker & M.E. Irwin (2 ♀, ANIC); 158 km S Newman (= 9 km N Kumarina Roadhouse) at 24°37.8′S 117°36.8′E [correctly: 119°36.8′E], 24 Apr–7 May 2003, F.D. Parker and M.E. Irwin (7 ♀, 2 ♂, ANIC; 4 ♀, 1 ♂, CAS; 4 ♀, 1 ♂, USU); same data but 7–18 May 2003 (4 ♀, ANIC; 2 ♀, CAS; 3 ♀, USU).

***Sericophorus viridescens* Lomholdt, sp. nov.**
Figures 201, 208.

NAME DERIVATION.— *Viridescens*, Latin for *becoming green.*

RECOGNITION.— *Sericophorus viridescens* has the upper frons and postocellar area covered with erect setae, the anterior declivity of tergum I concave, the head, thorax, propodeum, gaster, and femora metallic green (metallic luster inconspicuous on mid- and hindfemora); flagellum yellowish brown. Also, the propodeal dorsum is punctate on each side of median sulcus. *Sericophorus evansi* is similar, but *viridescens* differs in having the median sulcus of the propodeal dorsum as wide as the length of metanotum (Fig. 208c), the mesopleuron microsculptured between punctures, the outer lateral tooth of the middle clypeal section prominent (Fig. 208a), the greatest length of flagellomere V 0.6 × apical width, and the rake of the female forebasitarsus elongate (length of apical spine about 1.8 × basitarsus apical width). In *evansi*, the median sulcus of the propodeal dorsum is markedly narrower than the length of the metanotum, the mesopleuron is unsculptured mesally between punctures, the outer lateral tooth of the middle clypeal section is nonprominent (Fig. 64a), the greatest length of flagellomere V 0.8 × apical width, and the apical rake spine of the female forebasitarsus is about 1.3 × as long as basitarsus apical width.

DESCRIPTION (based on holotype only).— Frons swollen near center; frontal punctures averging about one diameter apart; frontal line an unsculptured, triangular area. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 0.8 × hindocellar width. Scutal punctures on disk up to about 2–3 diameters apart; scutal flange gradually narrowing posterad. Mesopleural punctures averaging several diameters apart. Propodeal dorsum punctate, foveolate along anterior margin, with broad median sulcus (sulcus width equal to length of metanotum) that contains three transverse carinae and no median carina (Fig. 208c); side somewhat irregularly microreticulate, separated from posterior surface by series of relatively small, oblique ridges (no longitudinal ridge); posterior surface ridged on each side of median

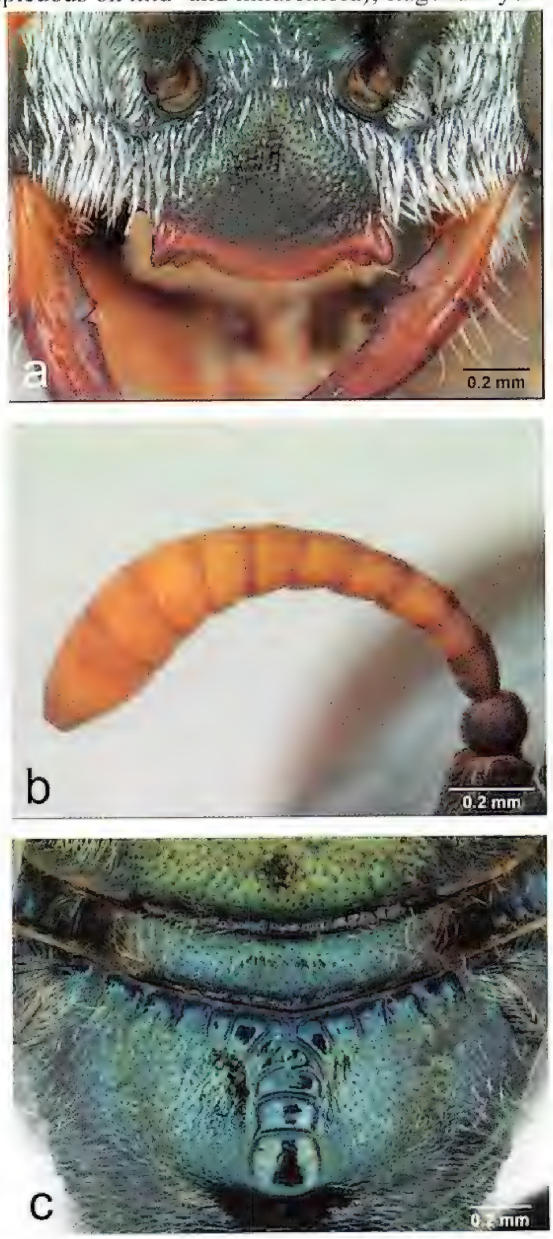

FIGURE 208. *Sericophorus viridescens* Lomholdt, sp. nov.: a – female clypeus in frontal view; b – female flagellum; c – propodeal dorsum of female in dorsal view.

sulcus. Forewing vein M interstitial with cu-a in left wing, diverging slightly basad to cu-a in right wing; second submarginal cell triangular. Forecoxal punctures 2–3 diameters apart at center. Horizontal area of tergum I with punctures that average about one diameter apart; anterior declivity markedly concave.

Setae silvery, partly obscuring integument on lower frons along orbit and on clypeus laterally; erect on upper frons and postocellar area, about as long as 0.8 × midocellar width on interocellar area; suberect, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster metallic green with the following exceptions: mandible and middle clypeal section along lamella reddish brown; scape and pedicel black; flagellum yellowish brown, flagellomere I dark. Forefemur metallic green, mid- and hindfemora black, with green metallic luster; foretibia reddish brown, mid- and hindtibiae black; tarsi dark brown, apical tarsomeres reddish brown. Pygidial plate of female reddish brown apically.

♀.— Orbital fovea ill defined. Flagellum clavate (Fig. 208b); dorsal length of flagellomeres I about 1.3 × apical width, of flagellomere II 1.1 × apical width; greatest length of flagellomere IX equal to 0.6 × apical width, of flagellomere X 1.3 × basal width. Clypeal lamella arcuate, lateral tooth prominent (Fig. 208a). Forebasitarsus with seven rake spines, apical spine about 1.8 × basitarsus apical width. Length 7.6 mm.

♂.— Unknown.

Geographic distribution (Fig. 201).— Known from one locality in southern part of Northern Territory.

Records.— Holotype: ♀, **AUSTRALIA**: **Northern Territory**: 33 km WNW Alice Springs at 23°36′S 133°34′E, 30 Sept 1978, J.C. Cardale (ANIC).

Sericophorus viridis (de Saussure)

Figures 209–211.

Tachyrrhostus viridis de Saussure, 1854:25, ♀. Lectotype: ♀, New Holland, now Australia: no specific locality (MHNG), **present designation by O. Lomholdt**, examined by O. Lomholdt and W. Pulawski.— As *Sericophorus viridis*: F. Smith, 1856:356 (new combination, in catalog of Hymenoptera in British Museum); de Saussure, 1863:69 (transfer to *Sericophorus* recorded); Froggatt, 1892:221 (in catalog of Australian Hymenoptera); Dalla Torre, 1897:578 (in catalog of world Sphecidae); W. Schulz, 1911:183 (redescription); Turner, 1914c:349 (in revision of Australian *Sericophorus*); Rayment, 1955a:54 (original description translated into English; additional description); Matthews and Evans, 1971:413 (nesting habits), 423 (description of larva); Bohart and Menke, 1976:302 (listed); Cardale, 1985:250 (in catalog of Australian Sphecidae); McCorquodale and Thomson, 1989:95 (citation of Matthews and Evans, 1971).

Tachyrhostus [*sic*] *claviger* Kohl, 1892:229, ♀. Holotype: ♀, Australia: no specific locality (originally NHMW, now lost?), not examined by O. Lomhold or W. Pulawski. **New synonym by O. Lomholdt.**— As *Sericophorus claviger*: Dalla Torre, 1897:578 (new combination, in catalog of world Sphecidae); Turner, 1914c:350 (in revision of Australian *Sericophorus*); Rayment, 1955a:29 (in revision of Australian *Sericophorus*, as new combination), Bohart and Menke, 1976:302 (listed); Cardale, 1985:246 (in catalog of Australian Sphecidae).

Sericophorus claviger burnsiellus Rayment, 1955a:30, ♂. Holotype: ♂, Australia: Victoria: Chelsea (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:246 (in catalog of Australian Sphecidae).

Sericophorus elegantior Rayment, 1955a:32, ♀. Holotype: ♀, Australia: Western Australia: Bolgart (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:247 (in catalog of Australian Sphecidae).

Sericophorus occidentalis Rayment, 1955a:38, ♀. Holotype: ♀, Australia: Western Australia: Narrogin (WAMP), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:248 (in catalog of Australian Sphecidae).

Sericophorus spryi Rayment, 1955a:48, ♂. Holotype: ♂, Australia: Victoria: Chelsea (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:249 (in catalog of Australian Sphecidae).

Sericophorus tallongensis Rayment, 1955a: 50, ♂. Holotype: ♂, Australia: New South Wales: Tallong (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:250 (in catalog of Australian Sphecidae).

Sericophorus teliferopodus Rayment, 1955a:51, ♀, ♂. Holotype: ♀, Australia: Victoria: Sandringham (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Rayment, 1955a:66 (nesting and prey); Bohart and Menke, 1976:302 (listed); Cardale, 1985:250 (in catalog of Australian Sphecidae).

Sericophorus teliferopodus okiellus Rayment, 1955a:52, ♀. Holotype: ♀, Australia: Victoria: Melton (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:250 (in catalog of Australian Sphecidae).

Sericophorus viridis roddi Rayment, 1955a:55, ♀. Holotype: ♀, Australia: New South Wales: Fraser Park (NMV), examined by O. Lomholdt. **New synonym by O. Lomholdt.**— Rayment, 1955a:78 (nesting and prey); Bohart and Menke, 1976:302 (listed); Cardale, 1985:251 (in catalog of Australian Sphecidae).

Sericophorus violaceus Rayment, 1955a:53, ♀, ♂. Holotype: ♀, Australia: South Australia: Torrens Gorge (SAM), examined by O. Lomholdt and W. Pulawski. **New synonym by O. Lomholdt.**— Bohart and Menke, 1976:302 (listed); Cardale, 1985:250 (in catalog of Australian Sphecidae).

Recognition.— *Sericophorus viridis* has the setae erect on the upper frons and postocellar area, a concave anterior declivity of tergum I, a nonmetallic head, contrastingly metallic blue or violet thorax, propodeum and terga, the propodeal side separated from the posterior surface by a series of oblique ridges that may be crossed by a zigzagging longitudinal ridge, and (like *niveifrons*) male flagellomeres II-VI prominent ventrally (Fig. 209c). Unlike similar species (*argentifacies*, *niveifrons*, *littoralis*, *ruficollis*), the setae of *viridis* are about 1.0–1.2 × as long as the midocellar width on the interocellar area and about 0.7–1.0 × midocellar width on the scutum (rather than 0.6–0.8 × and 0.3 × midocellar width, respectively). Unlike *niveifrons*, the scutum and mesopleuron are markedly microsculptured between punctures, dull (rather than unsculptured, shiny). Unlike *argentifacies*, the mesopleural punctures of *viridis* are well defined, averaging no more than two diameters apart beneath scrobe (rather than ill defined, averaging several diameters apart) and the median sulcus of the propodeal dorsum has a sharp lateral margin (rather than dull).

Justification of new synonymy.— The long list of new synonyms reflects extensive color variation, as well as minor sculptural variation due to allometric growth. Male genitalia and secondary sexual characters, however, are remarkably constant.

The holotype of *Tachyrrhostus claviger* Kohl is apparently lost, but the good original description leaves no doubt about that species identity.

Description.— Frons swollen near center; frontal punctures averaging about one diameter apart, markedly more near top of swelling; frontal line evanescent except conspicuous on frontal swelling; interocellar area convex adjacent to hindocellus, concave mesally. Ocellocular distance equal to 1.6–1.7 × hindocellar width. Scutal punctures well defined, averaging more than one diameter apart near center; scutal flange gradually narrowing toward apex. Mesopleural punctures well defined, averaging more than one diameter beneath scrobe. Scutellum slightly, obtusely conical at center. Propodeal dorsum punctate, admedian punctures varying from fine, about two diameters apart, to somewhat larger, about one diameter apart (with interspaces in many specimens merging into microscopic ridges); adjacent to foremargin with deep, crenulate sulcus that extends mesally into wide, well-defined, glabrous, longitudinal sulcus; the latter with several transverse carinae and sharp lateral margin; side punctate (except anteriorly), delimited from posterior surface by oblique ridges that in many specimens are crossed by longitudinal, zigzagging carina; posterior surface punctate (except for median sulcus). Forewing vein M interstitial with cu-a; second submarginal

cell narrowly open anteriorly. Tergum I with anterior declivity markedly concave; punctures about one to two diameters apart on horizontal area mesally, less than that on following terga, interspaces microareolate; apical depressions of terga I and II punctate throughout.

Setae silvery on lower frons and clypeus, not concealing integument; erect on upper frons and postocellar area, on interocellar area about as long as 1.0–1.2 × midocellar width; on scutum dark, suberect, 0.7–1.0 × as long as midocellar width; suberect on propodeal dorsum.

Head black (frons with dark bronzy tinge in many specimens) except the following: middle clypeal section reddish brown in female and many males, and lateral clypeal section in most females (at least partly so); mandible yellowish reddish brown to brown red, apex brown; antenna reddish brown in female, largely darkened in male. Thorax and propodeum metallic blue or violet, pronotal lobes reddish in female. Legs all reddish brown in most females, femora darkened basally in most males, but mid- and hindlegs almost black in single females from Childers and Herberton, Queensland, and all legs black in female from Victoria Highway, Northern Territory and in male from Cooloola National Park, Queensland. Terga metallic blue, with golden tinge in many specimens; apical segment in female, two apical segments in male, reddish brown.

♀.— Orbital fovea ill defined. Clypeal lamella slightly arcuate (Fig. 209a). Dorsal length of flagellomere I 1.4 × apical width, of flagellomere II 1.3 × apical width; greatest length of flagellomere IX 0.7 × apical width, of flagellomere X 1.2 × basal width. Forebasitarsus with seven or eight rake spines. Setae of

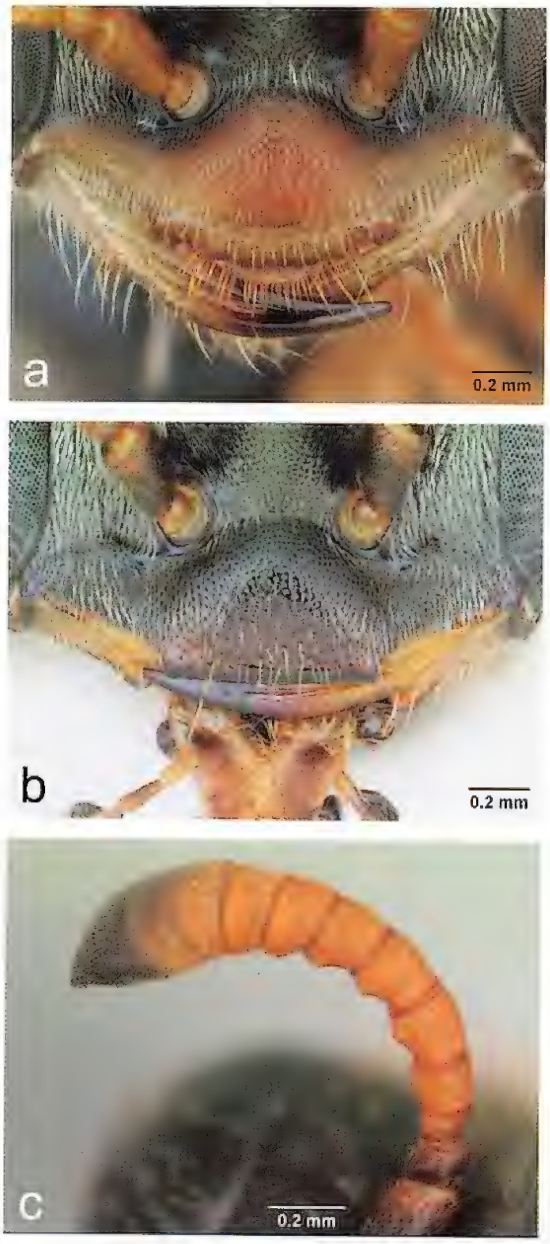

FIGURE 209. *Sericophorus viridis* (de Saussure): a – female clypeus in frontal view; b – male clypeus in frontal view; c – male flagellum.

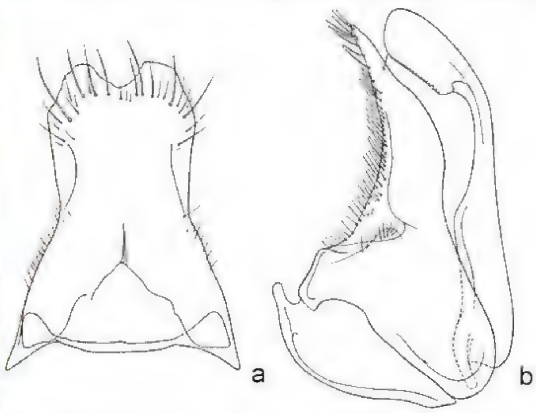

FIGURE 210. *Sericophorus viridis* (de Saussure): a – sternum VIII of male; b – male genitalia in lateral view.

pygidial plate largely concealing integument. Length 9.0–12.5 mm.

♂.— Clypeal lamella straight, lateral corner angulate, prominent (Fig. 209b). Dorsal length of flagellomere I 0.7 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.5 × apical width, of flagellomere X 1.2–1.3 × basal width. Flagellomeres II-VI prominent ventrally (Fig. 209c). Forebasitarsus with five or six rake spines. Sternum VIII emarginate apically (Fig. 210a). Genitalia: Fig. 210b. Length 5.0–9.0 mm.

Nesting habits (Matthews and Evans, 1971).— *Sericophorus viridis* nests in open, sandy-loamy, hard packed soil, often in large aggregations. The main shaft is vertical, from 10 to 50 cm deep. Cells are placed in a radiating pattern, each at the end of a more or less horizontal tunnel extending 1 to 14 cm from the main shaft. The lowest (oldest) cell is usually provisioned first. Apparently, most digging is done at night or in the very early morning. Provisioning takes place during the first hours of the morning (between 6.20 and 6.50 a.m. on 26 Nov 1970; temperature was about 15°C, and no other Hymenoptera were active at this time). Prey consists exclusively of male blowflies (see list below) of which about 6 specimens constitute the provision for each larva. *Calliphora tibialis* Macquart was preferred by the Black Mountain population near Canberra. The prey is flown to the nest, and hold near its wing base by the wasp's hind legs only (the sting was never observed to be used for holding the fly). *Acanthostethus portlandensis* Rayment (Crabronidae: Nyssonini) is a nest parasite.

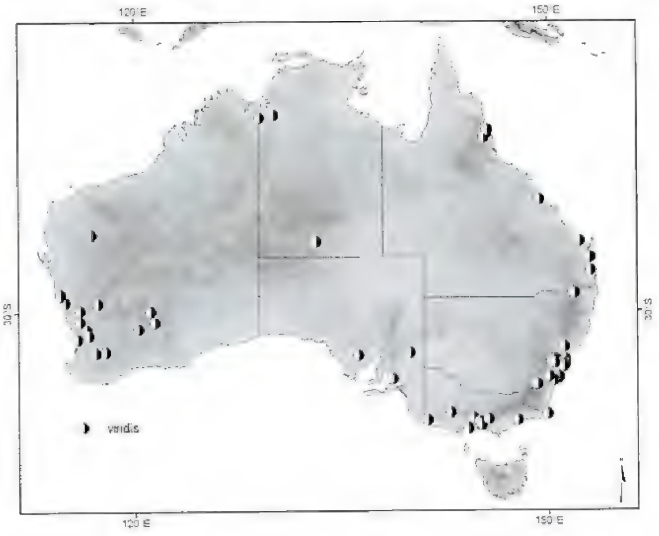

Figure 211. Collecting localities of *Sericophorus viridis*.

The following are the prey species (Matthews and Evans, 1971; Rayment, 1955): Calliphoridae: *Calliphora tibialis* Macquard, *accepta* Malloch, *sternalis* Malloch, *stygia* (Fabricius), and *Lucilia cuprina* (Wiedemann); Muscidae: *Musca vetustissima* Walker and *fergusoni* Johnston and Bancroft.

Matthews and Evans (1971) described the larva, concluding that it was very similar to that of *Liris*.

Geographic distribution (Fig. 211).— All Australia except Tasmania.

Records (the allotype of *teliferopodus* mentioned by Rayment, 1955a:51, and the paratypes of *viridis roddi* have not been available).— **AUSTRALIA**: **Australian Capital Territory**: Black Mountain, 4 Mar 1984 (1 ♀, ANIC) and 8 Jan 1988 (1 ♀, UCD); Black Mountain Peninsula, Canberra, Jan, Feb 1972 (8 ♀, MCZ, ANIC); Canberra, 27 Jan (2 ♀, AEI), 5 Feb 1960, 24 Mar 1961, 29 Nov 1962, 6 Jan 1970 (4 ♀, ANIC). **New South Wales**: Baulkham Hills, 23 Jan 1965 (1 ♀, ANIC); Bilpin near Kurrajong, Nov and Dec 1977 and 1978 (6 ♀, 5 ♂, AMS; 1 ♂, CAS); 5 km E Bilpin, 9 and 11 Nov 1977 (1 ♀, 1 ♂, AMS); 3 km NE Bilpin, 26 Dec 1992 (2 ♂, AMS); 6 km NE Bilpin, 12 Nov 1988 (1 ♀, AMS); Blue Mountains, 9 Feb 1915 (1 ♀, AMS); Blue Mountains: Blackheath, Feb 1916 (1 ♀, QMB); Blue Mountains: Clarence, 9 Feb 1978, 13 Feb 1978, 7 Feb 1979, and 20 Feb 1992 (2 ♀, 2 ♂, AMS); Blue Mountains: Narrow Neck, 1 Feb 1980 (1 ♀, AMS); Blue Mountains: 3 km S Mount Wilson, 8 Nov and 9 Mar 1978 (2 ♀, AMS); Botanical Gardens, 1

Nov 1912 (1 ♀, AMS); Botany Bay (1 ♂, USNM); Brisbane Waters National Park, 10 Dec 1986 (1 ♂, CAS); Cheltenham, 14 Jan and 16 Dec 1951 (2 ♀, AMS); Cooks River, 24 Nov 1912 (2 ♀, BCRI); Epping, 3 Dec 1986 (1 ♀, AMS); Fraser Park, 27 Dec 1947 (1 ♀, NMV, holotype of *viridis roddi*); Frenchs Forest N Sydney, 14 Dec 1923 (1 ♀, AMS); Jamberoo, 23 Jan 1950 (1 ♀, AMS, labeled *S. rufa* Rayment, manuscript name); Lane Cove, 5 Nov 1944 and 21 Feb 1948 (2 ♀, AMS, labeled *S. rufa* Rayment, manuscript name), also 6 Jan 1947 (2 ♂, AMS); Lindfield, 20 Nov 1983 (1 ♀, ANIC); Liverpool, 10 Nov 1944 (1 ♀, USNM); Middle Harbour, 30 Dec 1905 (1 ♀, AMS, labeled subsp. *rufa* Rayment, manuscript name); Mosman, 12 Dec 1978 (2 ♀, BCRI); Mount Tomah in Blue Mountains, 3 Mar 1991 (1 ♀, AMS); Mount Victoria, 5 Jan 1931 (2 ♀, ANIC, MCZ); Nadgee Nature Reserve, 13 Jan 1987 (1 ♀, UCD); Seven Mile Beach (31 Dec 1960 (1 ♀, AMS); Shoalhaven (1 ♀, BCRI); Singleton, 11 Jan 1966 (1 ♂, UQIC); Sydney, 2 Apr 1918 (2 ♀, 1 ♂, AM, ANIC, QMB), Nov 1915 (3 ♀, USNM), Dec 1903 (1 ♀, BISH), 8 Dec 1918 (1 ♂, QMB, labeled cotype of *claviger burnsiellus* by Rayment, but mentioned under *S. claviger claviger* in original description); Sydney: Dobroyd Point near North Harbour, 14 Dec 1923 and 27 Nov (5 ♀, AMS); Sylvania near Sydney, 4 Dec 1981 (1 ♀, BCRI); Tallong, 20 Dec 1950 (2 ♂, NMV, holotype and paratype of *tallongensis*), also 19 Dec 1950 1 ♂, AMS); Tempe, 4 Dec 1893 (1 ♀, QMB); Woodford, 4, 17 and 31 Jan 1919 (3 ♀, BMNH), 23 Nov 1972 (1 ♀, CAS; 1 ♀, FSCA), 30 Nov 1972 (1 ♀, FSCA); 16 Jan 1979 (1 ♀, AMS); no specific locality and date (3 ♀, AMNH; 2 ♀, MHNG). **Northern Territory**: Keep River National Park at 15°55′22″S 129°03′25″E, 25 June 2001 (2 ♂, USU); 27 km S Mount Breaden at 24°53′S 133°12′E, 22 Sept 1978 (1 ♂, ANIC); 38.5 km SW Timber Creek on Victoria Highway at 15°42′40″S 130°07′48″E, 6–13 June 2001 (1 ♀, USU). **Queensland**: Amiens, 4 Nov 1965 (1 ♂, UQIC); Brisbane: Bribie Island, 15 Nov 1972 (2 ♂, FSCA); Childers Road near Bundaberg, 29 Nov 1972 (1 ♀, ANIC); Cooloola National Park 4 km W Rainbow Beach, 4 Feb 1978 (1 ♂, CAS); Davies Creek 18 km SE Mareeba, 18 May 1980 (6 ♀, ANIC); Herberton (1 ♀, BMNH); Kuranda and vicinity, 4–13 Nov 1972 (4 ♀, ANIC; 1 ♀, CAS; 1 ♀, MCZ); Kuranda: Russet Park, 26 Oct 1987 (1 ♀, CAS); Sarina–St. Lawrence on Highway 1, 31 Aug 1986, 91 ♀, UCD); 2 km E Stanthorpe, 26 Nov 1976, on *Leptospermum attenuatum* (1 ♂, UQIC); Tewah Creek via Tin Can Bay, 18 Oct 1970 (1 ♂, UQIC). **South Australia**: 10 mi. W Kimba, 29 Nov 1958 (2 ♂, ANIC); Lilydale (1 ♂, NMV, paratype of *claviger burnsiellus*); Torrens Gorge, Jan 1940 (1 ♀, 1 ♂, SAM, holotype and allotype of *violaceus*). **Victoria**: 4 mi. E Anglesea, 22 Dec 1968, on *Leptospermum* sp. (2 ♂, UQIC); Ararat (1 ♀, QMB); Chelsea, 26 Oct 1918 (1 ♂, NMV, holotype of *claviger burnsiellus*), 8 Jan 1948 (2 ♂, NMV, holotype and cotype of *spryi*; locality after Rayment, 1955a:49, as no locality label present on specimens); Cheltenham, Nov 1918 (1 ♀, QMB); ca 15 km N Dartmoor, 3 Dec 1983 (1 ♀, WAMP); Langwarrin, 7 Feb 1901 (1 ♀, 1 ♂, BMNH); Melton, 27 Dec 1947 (1 ♀, NMV, holotype of *teliferopodus okiellus*); Noble Park, 1 Feb 1919 (1 ♀, QMB, 7 Feb 1901 (1 ♀, BMNH); River Nicholson and River Tambo, 1911 (1 ♀, WAMP); Sandringham, 10 Feb 1950 (1 ♀, NMV, holotype of *teliferopodus*; 1 ♀, AMS, paratype of *teli-feropodus*), 28 Feb 1950 (1 ♀, NMV paratype of *teliferopodus*), 4 Mar 1950 (1 ♀, AMS, paratype of *teli-feropodus*); Seaford, no date (1 ♀, AMNH); Warburton (1 ♀, NMV, paratype of *teliferopodus*); locality illegible, no date (1 ♀, AMNH). **Western Australia**: Bolgart, Mar 1951 (1 ♀, NMV, holotype of *elegantior*); Boorabbin Rock at 31°12′S 120°17′E, 20–21 Jan 1982 (1 ♀, WAMP); Coorow, 4 Nov 1958 (1 ♀, ANIC); Dongarra, 11–28 Oct 1935 (3 ♀, BMNH); Drummonds Cove near Geraldton, Sept 1972 (1 ♂, ANIC); Dundinin, no date (1 ♂, WAMP); Geraldton, Oct 1910 (1 ♂, MCZ); Goongarrie at 29°55′S 121°07′ to 121°14′E, Oct 1980 (2 ♀, CAS, 3 ♀, 3 ♂, WAMP); Kalgoorlie, Oct 1991 (1 ♀, WAMP); Moora, 6 Nov 1979 (2 ♀, UCD); Mount Augustus National Park at 24°21.9′S 116°52.2′E, 25 Apr 2001 (1 ♀, 1 ♂, ANIC; 1 ♀, CAS; 1 ♀, USU); 15 km NE Mount Singleton at 29°21′S 117°20′E, 28–29 Sept 1981 (1 ♀, ANIC); Narrogin (7 ♀, WAMP, holotype and paratypes of *occidentalis*; 2 ♀, ANIC, paratypes of *occidentalis*); Northam, 10 Nov 1979 (1 ♂, UCD); Pearce (1 ♀, WAMP); Perth, 1–7 Feb 1914 (1 ♀, BMNH); no specific locality but probably from Western Australia (1 ♀, NMV, paratype of *elegantior*). **No specific locality**: 2 ♀ (MHNG, lectotype and paralectotype of *Tachyrrhostus viridis*); 1 ♀ (holotype of *claviger*, originally in NHMW, now lost?).

Sericophorus wheeleri Lomholdt, sp. nov.

Figures 212–214.

NAME DERIVATION.— Named after William Morton Wheeler, who collected the first specimen

of this species. The name *Sericophorus wheeleri* was first used by V.L.S. Pate, who so labeled in 1938 the specimen now designated as the holotype.

Recognition.— *Sericophorus wheeleri* is characterized by an abundant, conspicuously long pilosity of the head, thorax, propodeum, and femora, and a metallic coloration of large part of the head, the whole thorax, propodeum, and gaster (all or largely so). It shares with *chalybeus* and *glaucus* the shape of the scutellum that is compressed mesally into an obtuse, longitudinal swelling in its basal half , apex of swelling prominent, differing in color from surrounding area. Unlike *chalybeus*, it has the upper frons black (Fig. 212a, b), the ocellocular distance equal to 1.8 ×

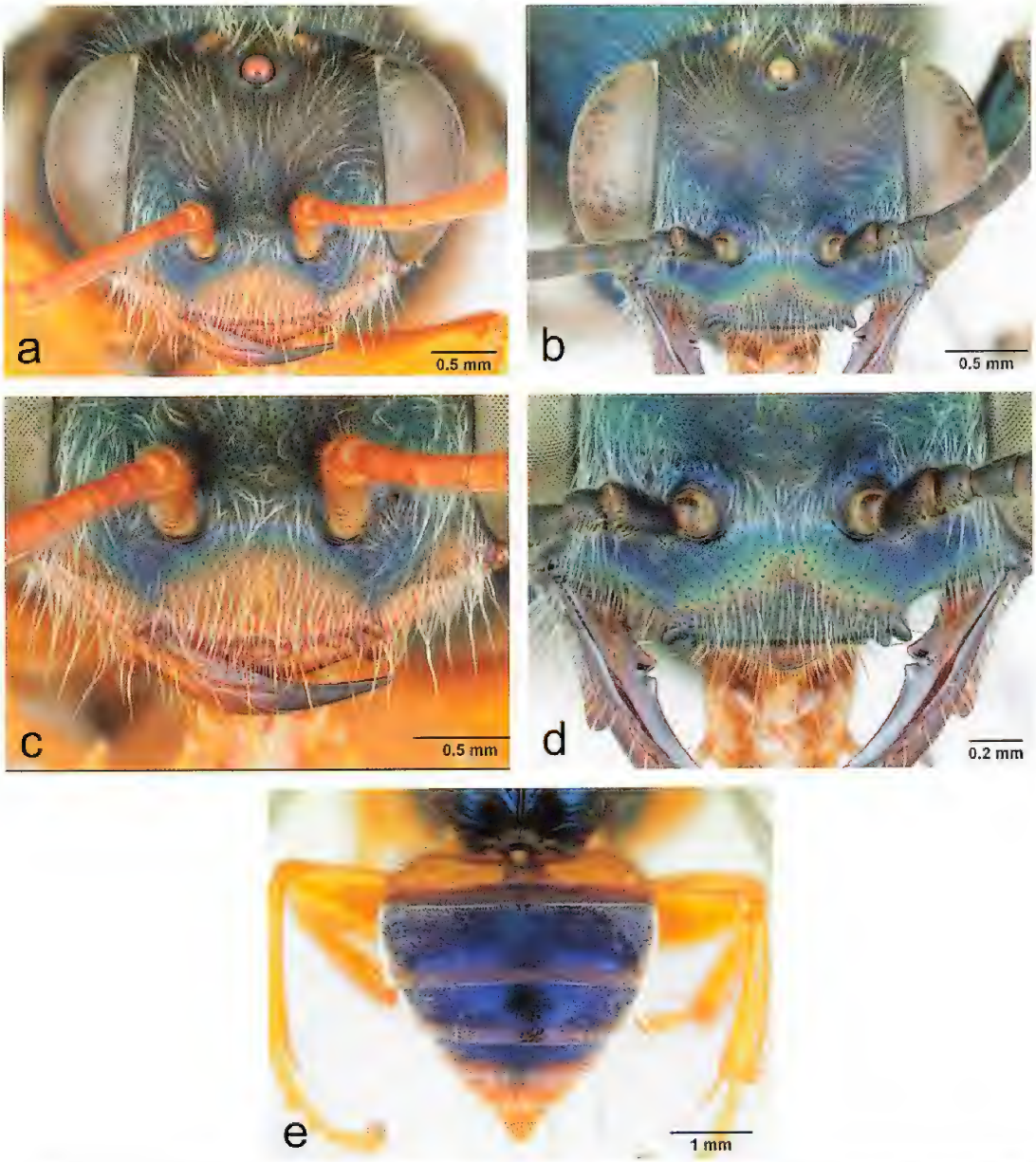

Figure 212. *Sericophorus wheeleri* Lomholdt, sp. nov.: a – female head in frontal view; b – male head in frontal view; c – female clypeus in frontal view; d – male clypeus in frontal view; e – female gaster in dorsal view.

hindocellar width, the setae longer (about 2.0 × midocellar width on interocellar area and 1.0 × on hindfemoral venter), the horizontal area of tergum I simple, the male antenna black and the femora metallic green. In *chalybeus* the entire frons is metallic green, the ocellocular distance equals 1.3 × hindocellar width, the setae are shorter (about 1.2–1.3 × midocellar width on interocellar area, about 0.5 × on hindfemoral venter), the horizontal area of tergum I has an obtuse anteromedian tubercle (ill defined in small males), the male flagellum (all or largely) and at least the forefemur are reddish brown. In *glaucus*, the ocellocular distance is 0.8 × hindocellar width, tergum I of female is all bluish green (partly reddish brown in most females of *wheeleri*), and the male antenna is reddish brown ventrally (black in male of *wheeleri*).

Description.— Head wide (Fig. 212a, b), width equal to 1.3 × height. Frons swollen near center; frontal punctures averaging several diameters apart, but about 1–2 diameters apart near center; frontal line ill defined. Clypeal lamella minimally arcuate in female, straight in male; outer tooth prominent. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance equal to 1.8 × hindocellar width. Pronotal collar not quite attaining level of scutum. Scutal punctures at center averaging about 3–4 diameters apart; scutal flange gradually narrowing posterad. Mesopleural punctures averaging about 2–3 diameters apart; episternal sulcus not foveolate. Scutellum conspicuously convex, compressed in basal half into obtuse, median swelling that raises posterad (swelling dark, contrasting in color with adjacent areas); apical half of scutellum in about same plane as metanotum. Propodeal dorsum sparsely punctate, with short, longitudinal ridges next to basal margin, with median sulcus that contains evanescent longitudinal carina and a few transverse carinae; side microsculptured, sparsely punctate, separated from posterior surface by series of coarse, oblique ridges (no longitudinal ridge); posterior surface with irregular ridges on each side of median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly or triangular. Tergal punctures about 1–2 diameters apart; anterior declivity of tergum I markedly concave; apical depressions of terga I and II punctate.

Setae unusually long on head, thorax, propodeum, and femora; not obscuring integument on frons and clypeus; erect on upper frons, postocellar area, scutum, and propodeal dorsum; setal length expressed in midocellar width: up to 2.0 × between mandibular base and notch, on interocellar area, on lower mesopleuron and forefemoral venter, about 1.5 × on scutum and midfemoral venter, and 1.0 × on hindfemoral venter; silvery on clypeus and lower frons (dark on frons in most females), dark on upper frons and postocellar area, in female black on scutum, scutellum, metanotum, and propodeal dorsum, reddish brown on mesopleuron, mesothoracic venter, and femora, in male black on thorax, propodeum, and femora.

Head metallic green except the following: upper frons black, middle clypeal section with copper luster (reddish brown ventrally in female, black in male), antenna reddish brown in female, black in male (dark reddish brown ventrally on middle flagellomeres in some specimens), mandible reddish brown (brown apically). Thorax and propodeum metallic green. Legs reddish brown in female, in male femora metallic green, tibiae and tarsi black (foretibial inner surface partly or all reddish brown). Female terga I-V dark blue to violet-purple (Fig. 212e), tergum I of most specimens largely reddish brown (this color limited to nar-

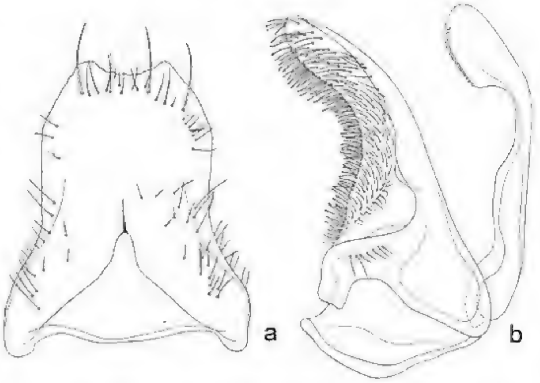

FIGURE 213. *Sericophorus wheeleri* Lomholdt, sp. nov.: a – sternum VIII of male; b – male genitalia in lateral view.

row transverse band on apical depression in some specimens); tergum VI, and in many specimens all sterna, reddish brown; male gaster all metallic green.

♀.— Orbital fovea ill defined (sculpture slightly finer than on adjacent area), broader apically than half ocellocular distance. Clypeal lamella with three lateral teeth on each side (Fig. 212c). Dorsal length of flagellomeres I and II about 1.5 × apical width; greatest length of flagellomere IX 1.0 × apical width, of flagellomere X about 1.3 × basal width. Metanotum in same plane as posterior area of scutellum. Forebasitarsus with six or seven rake spines. Gaster unusually wide (Fig. 212e). Length 8.0–11.5 mm.

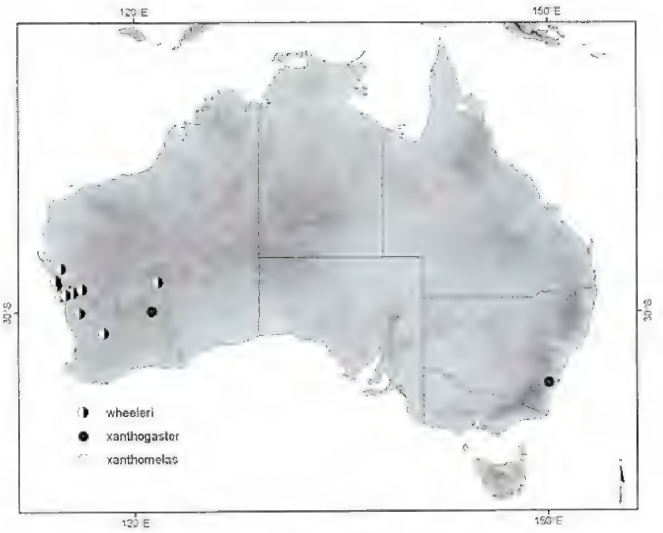

FIGURE 214. Collecting localities of *Sericophorus wheeleri*, *xanthogaster*, and *xanthomelas*.

♂.— Free margin of clypeal lobe straight (Fig. 212d). Dorsal length of flagellomeres I and II about 1.3 × apical width; greatest length of flagellomere IX 0.9 × apical width, of flagellomere X about 1.2 × basal width. Forebasitarsus with six or seven rake spines. Sternum VIII emarginate apically (Fig. 213a). Genitalia: Fig. 213b. Length 6.0–7.0 mm.

GEOGRAPHIC DISTRIBUTION (Fig. 214).— Western Australia.

RECORDS.— HOLOTYPE: ♀, **AUSTRALIA: Western Australia**: Mullewa, 14 Sept 1931, W.M. Wheeler (MCZ). PARATYPES: **AUSTRALIA**: **Western Australia**: 11 km ENE Anketell Homestead at 28°02′S 118°51′E, 4–6 Sept 1981, T.F. Houston (1 ♀, ANIC; 1 ♀ CAS ♀; 1 ♀, WAMP); Banjiwarn at 27°47′55″S 121°40′55″E, 4 May 1979, R.A. How (1 ♀, WAMP); 23 mi. W Binnu, 9 July 1972, N. McFarland (1 ♀, ANIC); Durokoppin Nature Reserve, 26 Aug 1988, G.P. Hall (1 ♂, CAS); East Yuna Nature Reserve 34 km WNW of Mullewa, 24–26 Aug 1985, T.F. Houston (3 ♂, WAMP); Geraldton, 1917, Clark (1 ♀, ANIC); Kalbarri turnoff, 18 July 1978, G.A. Holloway (1 ♀, AMS; 1 ♀, CAS); 1–5 km E Kalbarri, 18 July 1978, collector unknown (1 ♀, ANIC); Marchagee Nature Reserve near Coorow, 21 Aug 1982, M. Powell (1 ♀, CAS); 13 km S Wannoo at 26°49′S 114°37′E, July 1985, T.F. Houston (1 ♀, WAMP); Witcherina Dam on Greenough River at 28°43′S 115°00′E, 23 July 1989, M. Powell (1 ♀, WAMP); Wuraga: Marloo Station, Aug 1935, G. Goerling (1 ♀, ZMHU).

Sericophorus xanthogaster Lomholdt, sp. nov.

Figures 214, 215.

NAME DERIVATION: *Xanthogaster*, a Neolatin masculine adjective, derives from two Greek words: ξανθος, yellow, and γαστηρ, a gaster; a noun in apposition to the generic name; with reference to the yellow maculation of the gaster in this species.

RECOGNITION.— *Sericophorus xanthogaster* is unique in having a yellow scutellum, axilla, and metapleuron in combination with a black pronotum and yellow spots on all or most terga (Fig. 215a). Subsidiary recognition characters are: setae appressed on the postocellar area but erect on the upper frons and interocellar area (setal length 0.5 × midocellar width); flagellomeres III-X black; ocellocular distance about 1.5–1.6 × hindocellar width; propodeal dorsum coarsely reticulate (the reticulation may be almost totally concealed by appressed setae); and propodeal side sep-

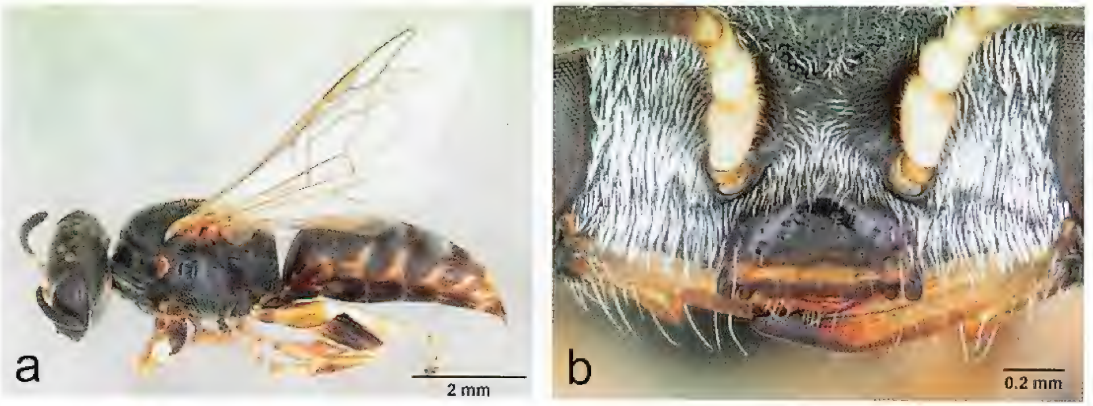

FIGURE 215. *Sericophorus xanthogaster* Lomholdt, sp. nov.: a – female body in lateral view; b – female clypeus in frontal view.

arated from posterior face by coarse ridges.

DESCRIPTION.— Frontal punctures varying (see below); frontal line inconspicuous, crossing oval, unsculptured area at about one third of frons height. Antennal socket separated from clypeal free margin by less than two socket widths. Ocellocular distance about 1.5–1.6 × hindocellar width. Middle clypeal section with sparse, well-defined punctures ventrally, densely punctate dorsally; clypeal lamella straight, lateral tooth prominent (Fig. 215b). Scutal punctures varying (see below), interspaces shiny; scutal flange gradually narrowing toward apex. Mesopleural punctures at least 2–3 diameters apart below scrobe (see below); interspaces shiny. Propodeal dorsum with deep, glabrous median sulcus that contains median carina and several transverse ridges; remaining surface coarsely rugose; side unsculptured except coarsely reticulate near junction with posterior surface; reticulation crossed by longitudinal carina on posterior surface laterally; posterior surface ridged except for median sulcus. Forewing vein M interstitial with cu-a; second submarginal cell narrowly open anteriorly. Forecoxal punctures varying (see below). Horizontal area of tergum I with microscopically small punctures that are about 1–2 diameters apart; apical depression conspicuously microsculptured; apical depression of tergum II minutely, densely punctate throughout.

Setae silvery, largely obscuring or not obscuring integument on frons lateroventrally and on lateral clypeal section (see below); erect on upper frons and interocellar area, about as long as 0.5 of midocellar width; appressed on postocellar area; suberect on scutum, about as long as 0.3 of midocellar width; on scutellum erect, as long as midocellar diameter, silvery or yellow (see below), largely missing in holotype; on propodeal dorsum oriented anterad, nearly appressed, almost totally concealing integument in holotype, but not in paratypes.

Head black except clypeus reddish brown adjacent to lobe free margin in holotype and clypeal lamella reddish brown in paratypes, mandible yellow basally (brown apically), and scape, pedicel, flagellomere I and venter of II pale yellow in holotype (remaining flagellomeres black). Thorax black but scutellum, axilla, and metanotum pale yellow; propodeum either all black or with large yellow spot laterally (see below). Fore- and midfemora black posteriorly, reddish brown or black anteriorly, midfemur yellow ventrally and apically; hindfemur dark brown or black except pale yellow basally and along narrow ventral strip, also apically in holotype; tibiae and tarsi yellow or black (see below). Gaster black, but the following are yellow, of varying size: posteromedian spot on tergum I, basomedian spot on tergum II, median spot on tergum III (ill defined in holotype), subbasal or subapical transverse spot on tergum IV, spot on tergum V, at least basal portion of tergum VI, and lateral spots on terga II-VI (Fig. 2215a).

♀.— Orbital fovea slightly wider apically than half ocellocular distance in holotype, absent in paratypes. Dorsal length of flagellomere I about 1.1–1.2 × apical width, that of flagellomere II 0.80.9 × apical width; greatest length of flagellomere IX equal to 0.8 × apical width, of flagellomere X 1.4–1.5 × basal width. Forebasitarsus with five to seven rake spines, length of apical spine 1.25–1.5 × apical width of basitarsus. Setae of pygidial plate not obscuring integument except apically. Length 5.4–8.1 mm.

♂.— Unknown.

Variation.— The specimens from New South Wales (paratypes) differ significantly from those from Western Australia (holotype), as indicated in the following table:

Table I. Geographic variation of *Sericophorus xanthogaster*.

	New South Wales	**Western Australia**
Frons punctures	averaging about one diameter apart laterally, about two diameters near center	averaging about one diameter apart
Clypeal middle section	evenly convex, densely punctate in about dorsal half	slightly concave in ventral half, densely punctate only along dorsal margin
Scutal punctures	about one diameter apart near center, less than that laterally	averaging many diameters apart (except near margins)
Scutal interspaces	slightly microsculptured	practically unsculptured near center
Mesopleural punctures	averaging 2–3 diameters below scrobe	averaging several diameters apart below scrobe
Forecoxal punctures	about 1–2 diameters apart	many diameters apart
Setae of lateroventral frons and lateral clypeus	not obscuring integument	largely obscuring integument
Setae of scutellum	yellow	silvery
Setae of propodeal dorsum	not obscuring integument	almost totally obscuring integument
Antenna	all black	scape, pedicel, flagellomere I and venter of flagellomere II yellow
Propodeum	ellow on side of dorsum and between side and posterior surface	all black
Fore- and midfemor	black anteriorly	reddish brown anteriorly
Tibiae	black (foretibia partly yellow)	yellow
Tarsi	foretarsus yellow, mid- and hindtarsi black	yellow
Body length	5.4–6.0 mm	8.1 mm
Orbital fovea	absent	present
Number of foretarsal rake spines	five or six	seven

Geographic distribution (Fig. 214).— Known from one locality in New South Wales and one in Western Australia.

Records.— Holotype: ♀, **AUSTRALIA: Western Australia**: Goongarrie at 29°55′10″S 121°14′45″E, depression in *Atriplex*, 8 Oct 1980, W.F. Humpreys (WAMP). Paratypes: **AUSTRALIA: New South Wales**: Nerriga, 18 Dec 1984, D.B. McCorquodale (1 ♀, ANIC; 1 ♀, CAS).

***Sericophorus xanthomelas* Pulawski, sp. nov.**
Figures 214, 216.

NAME DERIVATION.— *Xanthomelas* is a combination of two Greek words: ξανθος, yellow, and μελας, black, dark; with reference to this species coloration.

RECOGNITION.— *Sericophorus xanthomelas* is mainly characterized by the absence of specializations found in other species: the setae are appressed on the head and thorax, the frons is densely punctate, the clypeus is non-emarginate and without elevation, the glossa is shorter than scape, the mandibular posterior margin is straight between the base and the notch, the pronotal collar is not emarginate and reaches the level of the scutum, the propleuron is not expanded posterolaterally, the axilla is not expanded laterally, the subalar area is not expanded, the propodeal dorsum has no sublateral carina, three submarginal cells are present, the hindtibia is not swollen, the basolateral carina of tergum I ends well before the anterior margin of the spiracle, sternum I has no projection, and female tergum VI is densely punctate. The clypeus (except the lamella) is densely punctate, all black except next to eye, and the forecoxal venter and all trochanters are pale yellow. *Sericophorus crassicornis* and *kohlii* are similar, but in *xanthomelas* the flagellum dorsally and the pronotal collar are pale yellow; the forewing vein M is interstitial with cu-a, the femora are black (fore-and midfemora pale yellow apically), and the apical depressions of terga I and II are minutely punctate except impunctate along the hindmargins. In the other two species, the flagellum is bright yellowish brown dorsally, the pronotal collar is black, forewing vein M diverges from M-Cu basad of cu-a, the femora are yellow to reddish brown, and the apical depressions of terga I and II are impunctate.

DESCRIPTION (based on holotype only).— Frontal punctures minute, less than one diameter apart. Frontal line attaining midocellus. Ocellocular distance equal to 0.8 × hindocellar width. Scutal punctures less than one diameter apart; scutal flange ending abruptly. Mesopleural punctures less than one diameter apart near center. Propodeal dorsum with ridges that are conspicuous basally but become gradually evanescent toward apex, interspaces punctate; side practically unsculptured; posterior surface minutely punctate, interspaces merging into microscopic, transverse ridges (sculpture largely hidden by pilosity). Forewing vein M interstitial with cu-a; second submarginal cell triangular. Tergum I: punctures of horizontal area about 1–2 diameters apart; apical depression minutely punctate except along hindmargin; apical depression of tergum II impunctate except apicomesally.

Setae of lower frons and clypeus silvery, not obscuring integument; appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

Head, thorax, propodeum, and gaster black except the following are pale yellow: small spot on clypeus adjacent to mandibular articulation, mandible between articulation and notch (remaining brown), scape (brown basodorsally), pedicel, flagellum (brown ventrally, apical flagellomere brown in apical third), and pronotal collar; pronotal lobe black. Forecoxal venter and all trochanters pale yellow; femora black, fore- and midfemora pale yellow apically; foretibia yellowish dorsally, brown ventrally and

FIGURE 216. *Sericophorus xanthomelas* Pulawski, sp. nov.: female clypeus in frontal view.

apically, midtibia brown, pale yellow basodorsally, hindtibia pale yellow dorsally, black ventrally, basally and apically; tarsi brown.

♀.— Orbital fovea ill defined, wider than half ocellocular distance. Free margin of clypeal lobe straight mesally, slightly arcuate sublaterally (Fig. 216). Dorsal length of flagellomeres I and II 1.1 × apical width; greatest length of flagellomere IX 0.8 × apical width, that of flagellomere X 1.9 × basal width. Forebasitarsus with five rake spines. Setae of pygidial plate concealing integument near apex. Length 5.1 mm.

♂.— Unknown.

Geographic distribution (Fig 214).— Known from one locality in northern Queensland.

Records.— Holotype: ♀, **AUSTRALIA: Queensland**: Hann River at 15°11′S 143°52′E, 17 Aug–15 Sept 1993, P. Zborowski and S. Shattuck (ANIC).

Acknowledgments

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Literature Cited

Bohart, R.M., and A.S. Menke. 1976. *Sphecid Wasps of the World. A Generic Revision.* University of California Press, Berkeley and Los Angeles, California, USA, and London, UK. 1 color plate, IX + 695 pp.

Cardale, J. 1985. Sphecidae, p. 218–303 *in* D.W. Walton (editor). *Zoological Catalogue of Australia, 2. Hymenoptera. Formicoidea, Vespoidea and Sphecoidea.* Australian Government Publishing Service, Canberra, Australia. vi + 381 pp.

Cockerell, T.D.A. 1914. A new fossorial wasp from Queensland. *The Canadian Entomologist* 46:271–272.

— 1932. Some wasps of the genus *Zoyphium*. *Memoirs of the Queensland Museum* 10:117–118.

Dalla Torre, C.G. 1897. *Catalogus Hymenopterorum hucusque descriptorum systematicus et synonymicus, Volumen VIII: Fossores (Sphegidae).* Guilelmi Engelmann, Lipsiae [= Leipzig]. 749 pp.

de Saussure, H. 1854. Mélanges hyménoptérologiques. *Mémoires de la Société de Physique et d'Histoire Naturelle de Genève* 14:1–76, pl. 1.

— 1863. Mélanges hyménoptérologiques. Appendice. Addenda et emendanda. *Mémoires de la Société de Physique et d'Histoire Naturelle de Genève* 17:69–76.

Enghoff, H. 1999. Ole Lomholdt. 8. maj 1946–9. februar 1999. *Entomologisk Meddelelser* 67:113–116.

Farris, J., V. Albert, M. Källersjö, D. Lipscomb, and A. Kluge. 1996. Parsimony jackknifing outperforms

neighbor joining. *Cladistics* 12:99–124.

Froggatt, W.W. 1892. Catalogue of the described Hymenoptera of Australia. *The Proceedings of the Linnean Society of New South Wales (Series 2)* 7:205–248.

Gibson, G.A.P. 1985. Some pro- and mesothoraxic structures important for phylogenetic analysis of Hymenoptera, with a review of terms used for the structures. *The Canadian Entomologist* 117:1395–1223.

Goloboff, P. 1993. Estimating character weights during tree search. *Cladistics* 9:83–91.

— 1999. *NONA, version 2*. Published by the author, Tucumán, Argentina.

Goloboff, P., and J. Farris. 2001. Methods for quick consensus estimation. *Cladistics* 17:S26–S34.

Goloboff, P., J. Farris, M. Källersjö, B. Oxelmann, M. Ramirez, and C. Szumik. 2003. Improvements to resampling measures of group support. *Cladistics* 19:324–332.

Goloboff, P, J. Farris, and K.C. Nixon. 2003. T.N.T. Tree analysis using new technology. *Cladistics* 24:774–786.

Hacker, H., and T.D.A. Cockerell. 1922. Some Australian wasps of the genera *Zoyphium* and *Arpactus*. *Memoirs of the Queensland Museum* 7:283–290.

Kohl, F.F. 1885. (1884). Die Gattungen und Arten der Larriden Autorum [sic]. *Verhandlungen der kaiserlich-königlichen Zoologisch-Botanischen Gesellschaft in Wien* 34:171–268, pl. VIII-IX, 327–454, pl. XI-XII.

— 1892. Neue Hymenopterenformen. *Annalen des k.k. Naturhistorischen Hofmuseums* 7:197–234, pl. XIII-XV.

— 1893. *Zoyphium*, eine neue Hymenopterengattung. *Verhandlungen der kaiserlich-königlichen Zoologisch-Botanischen Gesellschaft in Wien* 43:569–572.

— 1897. (1896). Die Gattungen der Sphegiden. *Annalen des k.k. Naturhistorischen Hofmuseums* 11: 233–516, pl. V-XI.

Lomholdt, O. 1985. A reclassification of the larrine tribes with a revision of the Miscophini of southern Africa and Madagascar (Hymenoptera: Sphecidae). *Entomologica Scandinavica* 24 (Supplement):1–183.

Matthews, R.W., and H.E. Evans. 1971 (1970). Biological notes on two species of *Sericophorus* from Australia (Hymenoptera: Sphecidae). *Psyche* 77:413–429.

McCorquodale, D.B., and C.E. Thomson. 1989. The prey of some Australian sphecid wasps (Hymenoptera). *Australian Entomological Magazine* 16:93–97.

Menke, A.S. 1967. New genera of Old World Sphecidae. *Entomological News* 78:29–35.

— 1977. *Aha*, a new genus of Australian Sphecidae, and a revised key to the world genera of the tribe Miscophini (Hymenoptera, Larrinae). *Polskie Pismo Entomologiczne* 47:671–681.

— 1988. *Pison* in the New World: a revision (Hymenoptera: Sphecidae: Trypoxylini). *Contributions of the American Entomological Institute* 24(3):iv + 171 pp.

Nielsen, E.T. 1933. Sur les habitudes des Hyménoptères aculéates solitaires. III. (Sphegidae). *Entomologiske Meddelelser* 18:259–348.

Nixon, K.C. 2002. *Winclada*, version 1.00.08. Published by the author, Ithaca, NewYork, USA.

Ohl, M. 2009. A new species of the wasp genus *Sericophorus* in New Caledonia (Hymenoptera: Apoidea: Crabronidae). *Mitteilungen des Internationalen Entomologischen Vereins E.V.* 34:27–32.

Pate, V.S.L. 1937. The generic names of the sphecoid wasps and their type species (Hymenoptera: Aculeata). *Memoirs of the American Entomological Society* 9:1–103.

Pulawski, W.J. 1989. *Sericophorus rhinoceros*, a new species from New Caledonia (Hymenoptera: Sphecidae). *The Pan-Pacific Entomologist* 65:319–321.

Radović, I.T., and S. Sušić. 1997. Morphological characteristics of the sting and prey carriage mechanism in *Sericophorus relucens* F. Smith (Hymenoptera: Sphecidae: Larrinae). *Proceedings of the Entomological Society of Washington* 99:537–540.

Rayment, T. 1955a. Taxonomy, morphology and biology of sericophorine wasps, with diagnoses of two new genera and descriptions of forty new species and six sub-species. *Memoirs of the National Museum of Victoria* 19:11–105.

— 1955b. Biology of two hunting wasps. The specific descriptions of a new species and one allotype of *Sericophorus*, and a new blowfly *Pollenia*. *The Australian Zoologist* 12:132–141, pl. XIX.

Rohwer, S.A. 1911. Descriptions of new species of wasps with notes on described species. *Proceedings of the United States National Museum* 40:551–587.

RONQUIST, F., AND F. NORDLANDER. 1989. Skeletal morphology of an archaic cynipoid, *Ibalia rufipes* (Hymenoptera: Ibaliidae). *Entomologica Scandinavica, Supplement* 33:1–60.

SCHULZ, W. 1911. (1912). Zweihundert alte Hymenopteren. *Zoologische Annalen* 4:1–220.

SHUCKARD, W.E. 1840. Chap. IV. The Hymenoptera, pp. 150–190 *in* W. Swainson and W.E. Shuckard. *On the History and Natural Arrangement of Insects*. Longman, Orme, Brown, Green & Longmans, and J. Taylor, London, England. iv + 406 pp. Published as vol. 129 of D. LARDNER (editor), The Cabinet Cyclopedia. Natural History.

SMITH, F. 1851. Descriptions of some new species of exotic Hymenoptera in the British Museum and other collections. *The Annals and Magazine of Natural History*, ser. 2, 7:28–33.

— 1856. *Catalogue of Hymenopterous Insects in the Collection of the British Museum. Part IV. Sphegidae, Larridae and Crabronidae*. Taylor and Francis, London, England. pp. 207–497.

— 1873. Descriptions of new species of fossorial Hymenoptera in the collection of the British Museum, and of a species of the rare genus *Iswara*, belonging to the Family Dorylidae. *The Annals and Magazine of Natural History*, ser. 4, 12:253–260, 291–300, 402–415.

TULLOCH, G.S. 1935. Morphological studies of the thorax of the ant. *Entomologica Americana*, New Series, 15:93–131, 8 pl.

TURNER, R.E. 1907. New species of Sphegidae from Australia. *The Annals and Magazine of Natural History*, ser. 7, 19:268–276.

— 1908. Notes on the Australian fossorial wasps of the family Sphegidae, with descriptions of new species. *Proceedings of the General Meetings for Scientific Business of the Zoological Society of London* 1908:457–535, pl. XXVI.

— 1912. Notes on fossorial Hymenoptera.— IX. On some new species from the Australian and Austro-Malayan Regions. *The Annals and Magazine of Natural History*, ser. 8, 10:48–63.

— 1914. Notes on fossorial Hymenoptera.— XIII. A revision of the Paranyssoninae. *The Annals and Magazine of Natural History*, ser. 8, 14:337–359.

— 1915. Notes on fossorial Hymenoptera.— XVI. On the Thynnidae, Scoliidae, and Crabronidae of Tasmania. *The Annals and Magazine of Natural History*, ser. 8, 15:537–559.

— 1916. Notes on fossorial Hymenoptera.— XIX. On new species from Australia. *The Annals and Magazine of Natural History*, ser. 8, 17:116–136.

— 1936. Notes on fossorial Hymenoptera.— XLV. On new sphegid wasps from Australia. *The Annals and Magazine of Natural History*, ser. 10, 18:533–545.

APPENDIX

N.B. Shortly afer submission of this manuscript for publication, the Department of Entomology, California Academy of Sciences, received a major collection of sphecid wasps willed to us by the late C. Giles Roche. A new, distinctive species of *Sericophorus* was found among other species. Another distinctive species was received from The Natural History Museum, London.

Sericophorus centralis Pulawski, sp. nov.

Figures 217, 218.

NAME DERIVATION.— The Latin masculine and feminine adjective *centralis* refers to the geographic center of Australia, near which the specimens were collected.

RECOGNITION.— *Sericophorus centralis* is unique in the genus in having an unusually wide glabrous area of the propodeal dorsum, occupying its central third (Fig. 217b), and a roundly expanded, but not elongate, basolateral carina of tergum I (Fig. 217d). A non-foveolate episternal sulcus, occipital carina not joining hypostomal carina, and yellowish, excessively densely punctate apical depressions of the terga are subsidiary recognition features.

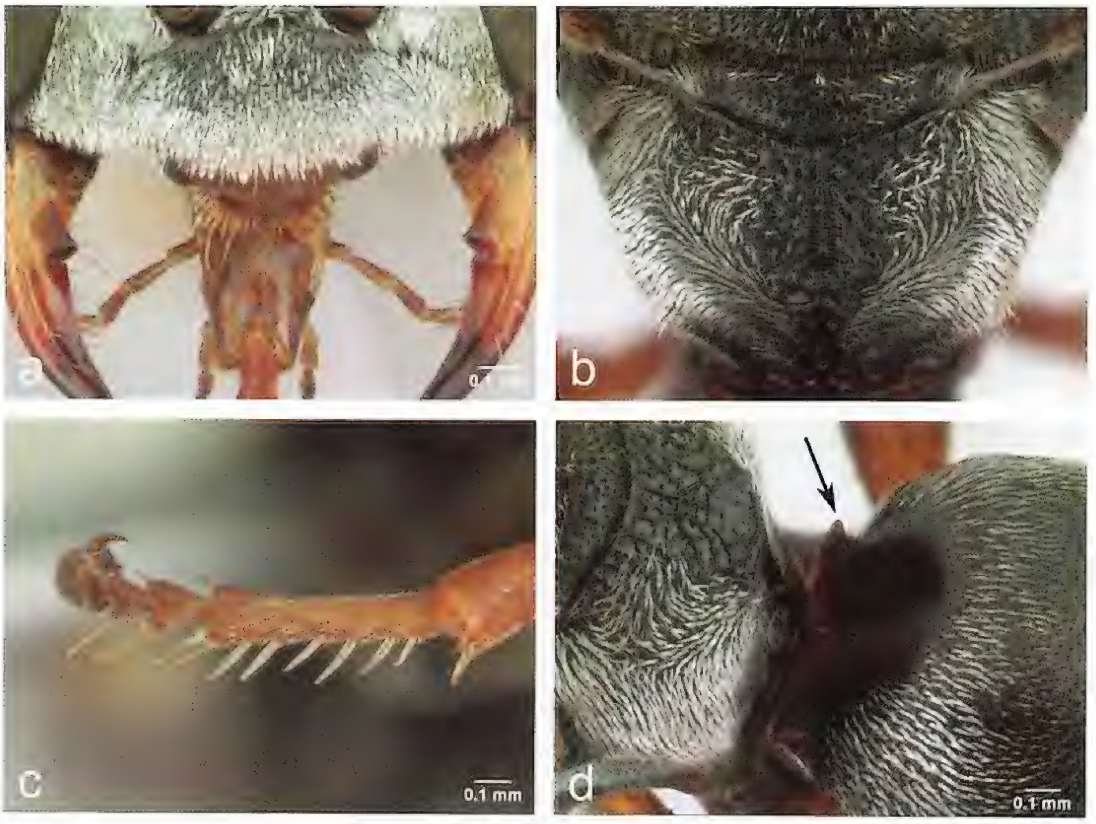

FIGURE 217. *Sericophorus centralis* Pulawski, sp. nov.: a – female clypeus in frontal view; b – propodeal dorsum of female; c – female forebasitarsus; d – base of tergum I in lateral oblique view (arrow indicates basolateral carina).

DESCRIPTION.— Frontal punctures minute, less than one diameter apart. Frontal line attaining midocellus. Ocellocular distance equal to 0.9 × hindocellar width. Occipital carina not joining hypostomal carina. Scutal punctures averaging less than one diameter apart; scutal flange rounded posteriorly; horizontal portion of axilla somewhat expanded, but outer margin straight, not convex. Most mesopleural punctures less than one diameter apart; interspaces unsculptured; episternal sulcus not foveolate. Propodeal dorsum coarsely rugose in median glabrous third, finely rugose in lateral third (sculpture difficult to

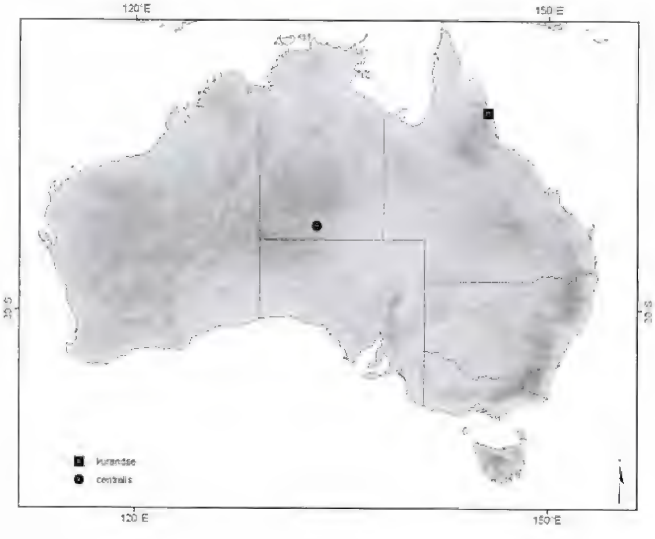

FIGURE 218. Collecting locality of *Sericophorus centralis* and *kurandae*.

see under dense pilosity); side rugose except unsculptured anteriorly; posterior surface ridged except for median sulcus. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell narrowly opened. Tergum I concave anteriorly; basolateral carina roundly expanded but not elongate; punctures of horizontal area averaging less than one diameter apart; apical depressions of terga I and II minutely punctate, punctures compressed against each other. Setae of frons and clypeus silvery, obscuring integument; appressed on upper frons, postocellar area, and scutum; median third of propodeal dorsum glabrous, setae appressed on lateral third, oriented anterad in posterior half, oriented toward midline in anterior half.

Head (including antenna), thorax, propodeum, and gaster black except mandible yellowish basally, pronotal lobe yellowish (holotype) or reddish brown (paratype) posteriorly, apical depressions of terga yellowish, and pygidial plate reddish brown. Femora, tibiae, and tarsi reddish brown in holotype, femora largely black in paratype.

♀.— Orbital fovea unrecognizable. Clypeal lamella with obtusely prominent lateral corner, not forming true tooth (Fig. 217a). Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.9 × apical width; greatest length of flagellomere X 1.5 × basal width. Forebasitarsus with 6–8 rake spines (Fig. 217c). Setae of pygidial plate largely concealing integument. Length 7.3–8.5 mm.

♂.— Unknown.

GEOGRAPHIC DISTRIBUTION (Fig. 218).— Known from one locality in Northern Territory, next to border with South Australia.

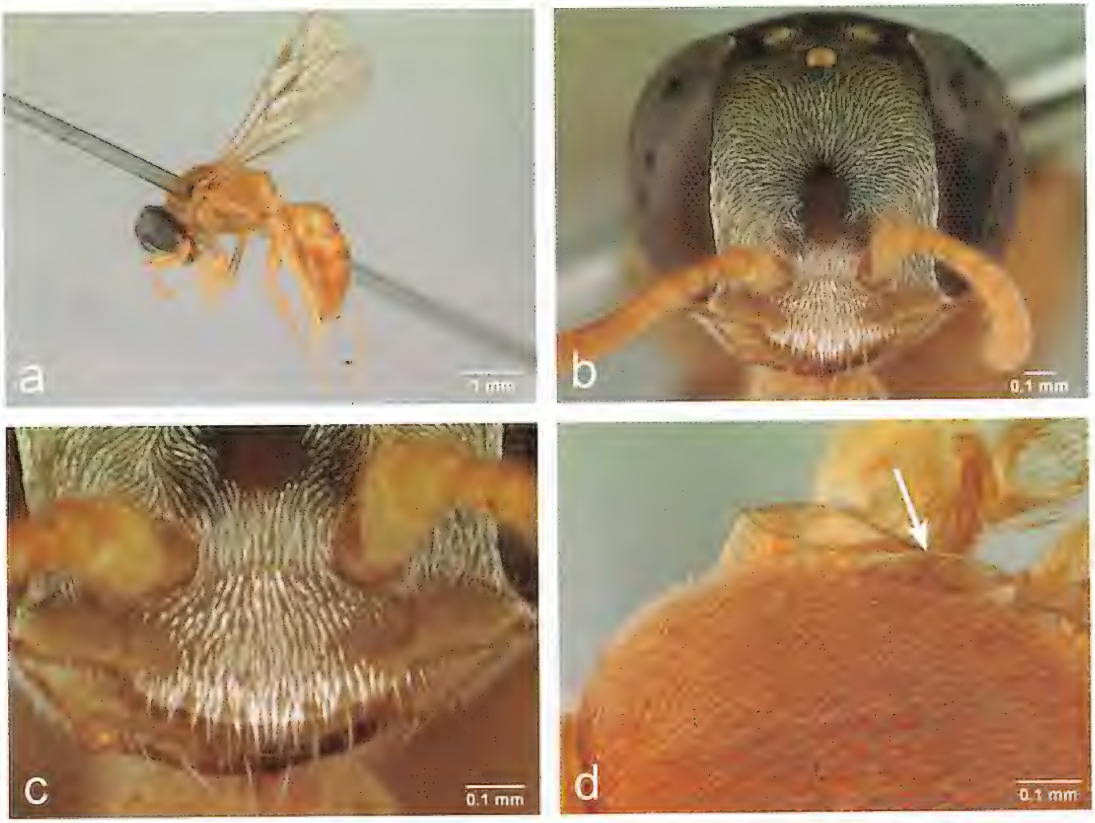

FIGURE 219. *Sericophorus kurandae* Pulawski, sp. nov.: a – body in lateral view; b – female head in frontal view; c – female clypeus in frontal view; d – part of female scutum (arrow indicates flange).

Records.— Holotype: ♀, **AUSTRALIA: Northern Territory**: 14 mi S Kulgera at 25°00′S 133°11.5′E, 15 Oct 1971, C.G. Roche (CAS). Paratype: same data as holotype (1 ♀, CAS).

***Sericophorus kurandae* Pulawski, sp. nov.**
Figures 218, 219.

Name derivation.— Named after Kuranda, a locality in northeastern Queensland, where the holotype was collected.

Recognition.— *Sericophorus kurandae* is unique within the genus in having the thorax, propodeum, entire gaster, and legs reddish brown (Fig. 219a), and an asetose, rounded, elongate area on the lower frons. The thorax, propodeum, and tergum I are also reddish brown in *dipteroides*, in which, however, terga II-VI are black or brownish and the frons are all setose. Additionally, the pronotal collar attains the level of scutum and the scutal flange is expanded (Fig. 219d) in *kurandae*, but not in *dipteroides*.

Description (based on holotype only).— Frontal punctures about one diameter apart. Frontal line absent, replaced by glabrous, round, elongate area in frons ventral half (Fig. 219b). Ocellocular distance equal to 0.9 × hindocellar width. Propleuron prominent posterolaterally. Scutal punctures about one diameter apart; scutal flange slightly more expanded than in other *Sericophorus* (Fig. 219d), ending abruptly. Mesopleural punctures near center about one diameter apart. Propodeal dorsum minutely punctate and minutely, longitudinally ridged; side largely unsculptured, not separated by carina from posterior surface; posterior surface microscopically punctate and with minute longitudinal ridges adjacent to median sulcus. Forewing vein M diverging from M+Cu basad of cu-a; second submarginal cell narrowly opened. Tergum I concave anteriorly, punctures of horizontal area averaging about 2–3 diameters apart; apical depressions of terga I and II impunctate.

Setae of lower frons and clypeus silvery, obscuring integument; round, elongate area above antennal base asetose; setae appressed on upper frons, postocellar area, and scutum; appressed, oriented anterad on propodeal dorsum.

Head black except clypeus and basal half of mandible yellow and flagellum reddish brown; thorax, propodeum, legs and gaster reddish brown.

♀.— Orbital fovea ill defined, about as wide as half ocellocular distance. Clypeal lamella with two lateral, ill-defined teeth on each side. Dorsal length of flagellomere I 1.1 × apical width, of flagellomere II 1.0 × apical width; greatest length of flagellomere IX 0.9 × apical width; greatest length of flagellomere X 1.6 × basal width. Forebasitarsus with seven rake spines. Setae of pygidial plate not concealing integument. Length 5.5 mm.

♂.— Unknown.

Geographic distribution (Fig. 217).— Known from one locality in northeastern Queensland.

Records.— Holotype: ♀, **AUSTRALIA: Queensland:** Kuranda at 16°49′S, 145°38′E, 2 Dec 1982, Z. Bouček (BMNH).

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PROCEEDINGS OF THE CALIFORNIA ACADEMY OF SCIENCES

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A New Species of *Scorpaenodes* (Pisces: Scorpaenidae) from the Galápagos and Cocos Islands with Discussions of the Limits of *Scorpaenodes* and *Thysanichthys*

Stuart G. Poss[1,4], John E. McCosker[2], and Carole C. Baldwin[3]

[1] *2638 NE Lillehammer Lane, Poulsbo, Washington 98370; Email: velvetfish1@hotmail.com;* [2] *Department of Aquatic Biology, California Academy of Sciences, 55 Music Concourse Drive, San Francisco, California 94118; Email: jmccosker@calacademy.org;* [3] *National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560; Email: baldwinc@si.edu*

Scorpaenodes rubrivinctus **sp. nov. is described from seven specimens taken at the Galápagos Islands, bringing the number of scorpaenids known from the archipelago to 15 species in eight genera. The new species was observed and photographed at 203–412 m, often in association with sponges, and collected during two expeditions using the deepwater submersible *Johnson Sea-Link* in 1995 and 1998. The species has been photographed, but not collected, from Cocos Island, Costa Rica. In head spination, general appearance and many body proportions, the new species is similar to *Thysanichthys crossotus*, but shares with species of *Scorpaenodes* palatines that are devoid or nearly devoid of teeth and the presence of a large slit posterior to the posteriormost hemibranch. Among shallow reef species of *Scorpaenodes, S. rubrivinctus* is similar to *S. albaiensis* and *S. minor*, which are placed in the genus *Hypomacrus* by some authors. Like *S. rubrivinctus*, those species also have a relatively elongate snout and dorsalmost unbranched rays that are significantly and abruptly longer than the ventralmost branched rays. The latter condition is also seen in *T. crossotus*. However, the new species differs from *S. albaiensis* and *S. minor* in having more vertical scale rows and distinct vertical bars, in fin-spine lengths, and in body proportions. It differs in a number of respects from other deep reef species of *Scorpaenodes*, most notably in anal fin-spine lengths. We place *S. rubrivinctus* in *Scorpaenodes*, pending future cladistic study, but note that generic reassignment may prove necessary because limits of both *Scorpaenodes* and *Thysanichthys* are unclear. A 655 bp nucleotide sequence of the cytochrome c oxidase Subunit I (COI) gene is presented.**

During 1995 and 1998, two of us (JM and CB) were fortunate to survey the Galápagos ichthyofauna using the one-atmosphere submersible *Johnson Sea-Link*. The volcanic nature, steep terrain, and strong currents of the Galápagos Archipelago provide a superb habitat for benthic scorpaenids, and at the same time makes deepwater fish collecting by traditional trawling and hook-and-line methods all but impossible. The maneuverability and observational opportunities of a manned submersible allowed us to observe and collect many new species and new records during dives to 1000 m (McCosker 1997), including the capture of six previously unknown and undescribed scorpionfishes. Amongst them was a dramatically-colored, elongate-snouted scorpionfish that we describe herein.

[4] Research Associate, Department of Ichthyology, California Academy of Sciences.

Fifteen scorpionfishes are now known from the Galápagos archipelago. Charles Darwin collected the first Galápagos scorpaenid specimens at San Cristóbal Island, which were later described by Jenyns (1840) as *Scorpaena histrio*. Meek and Newland (1885) and Jordan and Evermann (1898) recognized *Scorpaena fucata* Valenciennes, 1846, and *Scorpaena pannosa* Cramer, 1897, as junior synonyms of *S. histrio*. Examination of the holotypes by one of us (SP) corroborates those synonymies. Garman (1899) described the midwater *Ectreposebastes imus* from waters off the archipelago. *Scorpaenodes xyris* (Jordan and Gilbert, 1882) and *Scorpaena mystes* Jordan and Starks, 1895, are widely distributed in the tropical eastern Pacific and at the Galápagos (Grove and Lavenberg 1997). *Pontinus strigatus* was described from the Galápagos by Heller and Snodgrass in 1903. *Taenianotus triacanthus* Lacepède,1802, was reported by Wellington (1978) based on a specimen photographed underwater at James Island, but this widespread Indo-Pacific species has yet to be collected and most likely is a vagrant (Robertson et al. 2004). The Scorpaenidae of the Galápagos were summarized by Grove and Lavenberg (1997), who inadvertently repeated the error of Seale (1940) in listing a misidentification of *Scorpaenodes xyris* as *Scorpaenopsis gibbosa* (Bloch and Schneider 1801), which does not occur in the archipelago (McCosker 1998).

Subsequently, McCosker (2008) described *Trachyscorpia osheri* and *Idiastion hageyi*, collected using the submersible *Johnson Sea-Link* at the Galápagos Islands. *Scorpaena cocosensis* Motomura 2004 was collected in nearshore waters at Tagus Cove during the 1998 expedition, extending its known distribution from Cocos Island (Motomura and McCosker 2009). Also collected using the submersible during the two expeditions were specimens of *Phenacoscorpius* (Motomura and McCosker, in prep.), *Pontinus vaughani* Barnhart and Hubbs, 1946, *P. clemensi* Fitch, 1955, and two additional undescribed species of *Pontinus* (Poss, McCosker and Lavenberg, in prep.). Those fourteen scorpaenids, along with the new *Scorpaenodes* which we describe herein, demonstrate the remarkable benefits of exploration using manned submersibles, as well as the diversity of the Galápagos scorpaenid fauna.

Methods

Methods for taking counts and measurements follow those of Eschmeyer (1969b), as modified by Poss and Eschmeyer (1978), except that specimens were measured using digital rather than dial calipers. All measurements were recorded and analyzed to the nearest 0.01 mm, but reported to the nearest 0.1 mm. The last ray of both the dorsal and anal fins is typically split to its base, yet borne on a single pterygiophore. This last "double-ray" is counted here as 1½ to distinguish this condition from the much more infrequent condition in which it is not split to its base (and counted as 1), thereby avoiding the inconsistent counting of the fin-rays that has appeared in the literature of scorpaenoid species. As defined by Eschmeyer, the vertical scale-row count is the number of scale rows from the base of the supracleithral spine to the end of the hypural plate.

Abbreviations for depositories of specimens follow Leviton et al. (1985). A tissue sample from the USNM paratype is stored in 95% EtOH and deposited in the USNM fish collection.

Morphometric data from 44 body measurements and data for 4 variables derived from eight counts were maintained in separate database, input to the NTSYSpc numerical taxonomic analysis system (Ver. 2.20y), and analyzed independently. Sample sizes for the two multivariate analyses and the bivariate statistical contrasts included the 7 specimens of *S. rubrivinctus* and individuals of the following species: *Scorpaenodes albaiensis* (35 individuals in morphometric analysis, 30 in analysis of counts), *Scorpaenodes investigatoris* (2, 2), *Scorpaenodes littoralis* (28, 36), *Scorpaenodes minor* (28, 25), *Scorpaenodes smithi* (8, 8), *Scorpaenodes tribulosus* (3, 1), *Thysanichthys crossotus* (3, 3) and *Thysanichthys evides* (6, 6) for totals of 120 and 118 specimens in each analysis. These nearly always represent the same individuals. Except for one rare species, individuals

with damaged spines or missing scales were not analyzed. Lots from which counts and measures were taken are listed under comparative materials.

Bivariate comparisons based on the 43 measures used, as regressed against standard length (SL), are summarized in a separate section on morphometrics. Analyses of covariation were performed using the aoctool function in MATLAB (Ver. 7.04.365) of the MATLAB Statistical Toolbox and using two distinct models. The first testing, *via* ANCOVA, for the presence of different slopes among the species, $Y = (\alpha + \alpha_i) + (\beta + \beta i) \cdot SL + \varepsilon$, and the second testing, *via* ANCOVA, for the presence of different Y-intercepts, in the event slopes were found not to be significantly different, $Y = (\alpha + \alpha_i) + \beta \cdot SL + \varepsilon$. In nearly all cases, the latter model was found to provide the best fit, and slopes of nearly all variables were found not to differ significantly among species. Both Bonferonni and Sheffé adjustment procedures were employed in evaluating statistical significance in multi-way testing among species (Hochberg and Tamhane 1987). Neither correction differed in their effect and only probability values resulting from the Bonferonni procedure.are presented.

To assess better how *S. rubrivinctus* has differentiated morphometrically from its near relatives, size-adjusted principal components were obtained from a covariance matrix of log-transformed body (shape) measures by factoring out a 1 x 43 element isometric vector (1, 1, ..., 1), which served as an *a priori* representation of a pure size for Burnaby size correction (unit growth in each variable dimension defined; see Rohlf and Bookstein 1988). Principal components for data derived from counts were obtained separately using a correlation matrix of standardized variables. Five variables derived from 8 counts [total dorsal fin-rays (spines + soft rays), average number of pectoral fin rays (left + right/2), average number of total gill rakers (left + right/2), number of vertical scale rows, and average number of lateral-line scales (left + right/2)] were used in the principal components analysis (PCA) derived from a correlation matrix of these counts. Analyses of both datasets are discussed in a section titled Principal Components Analyses. NTSYSpc computes eigenvalues and eigenvectors using the QL algorithm with implicit shifts (Press et al. 1988) after standardization and tridiagonalization using Givens and Householder transformations.

***Scorpaenodes rubrivinctus* Poss, McCosker and Baldwin, sp. nov.**

Figures 1–3, 4A, 7–9,11–12; Tables 1–10 (Appendix)

Material examined.— Holotype: CAS 90384, 100.8 mm SL, ♂, San Cristobal Id., seamount SE of San Cristobal Id. (01°06′24″S, 89°07′02″W), 203 m, *Johnson Sea-Link*, JSL Dive 3937, J.E. McCosker, 18 Oct 1995. Paratypes: CAS 201883, 100.2 mm SL, ♂, Marchena Id. (00°24′00″N, 90°26′30″W), 303 m, JSL Dive 3109, J.E. McCosker and C.C. Baldwin, 21 Jul 1998. CAS 86532, 98.9 mm SL, ♂, Genovosa (Tower) Id. (00°21′48″N, 89°58′11′W), 280 m, JSL Dive 3974, J.E. McCosker et al., 24 Nov 1995. USNM 396088, 88.5 mm SL, ♂, 3 km E of Plazas Id. (00°32′24″S, 90°09′07″W), 305 m, JSL Dive 3096, J.E. McCosker and C.C. Baldwin, 9 Jul 1998. CAS 86511, 2(83.4-87.7 mm SL), ♀♀, Seymour Id. (00°23′15″S, 90°16′11″W), 308 m, JSL Dive 3980, J.E. McCosker, 27 Nov 1995. CAS 86524, 70.9 mm SL, ♂, Fernandina Id. (00°17′52″ S, 91°39′15″ W), 412 m, JSL Dive 3956, J.E. McCosker et al., 16 Nov 1995.

Diagnosis.— A species of *Scorpaenodes* with the following characteristics: pectoral fin with 18–20 rays, the dorsalmost unbranched rays of which are abruptly longer than the ventralmost branched rays; an elongate snout (13–15%SL) (Figs. 1 and 2); relatively elongate dorsal spines; distinct broad, orange or orange red vertical bars on the body that extend onto the fins (Fig. 3); nasal spines short, and bifid or absent in some specimens; spines of the suborbital ridge extended laterally to form a shelf; 43-51 vertical scale rows.

Description.— Dorsal: XIII, 8½ (1), XIII,9½* (5), XIII, 10½ (2) [asterisk denotes holotype]. Anal: III, 5 (1), III, 5½* (7). Pectoral Fin-Rays (left): 18*(2), 19(3), 20(3). Gill rakers (left): 4-6 (usually 5) + 1 + 9-12 (usually 10) = 15–17 (5 + 1 + 10 =16 in holotype). Vertical scale rows: 43–51

(holotype with 48). Lateral-line scales (left): 22-25 + 1 = 23–26 (usually, 24 +1, including holotype). Vertebrae 9 + 15 = 24 (n = 5, including holotype; Figure 4A).

Head large (45-47% SL) (Figs. 1 and 2). Snout notably extended (13-15% SL), length slightly greater than orbit diameter (12-13% SL). All head spines sharp, well developed, except nasal spines, which are relatively short when present, and except those on the lacrimal (Figs. 1 and 2). Lacrimal with a rounded lobe anteriorly, followed by two relatively robust, but weakly pungent spines that overlap the premaxilla — the first directed nearly ventrally, the second posteroventrally; a sharper spine on lateral face at posterior end of lacrimal. Second infraorbital bone with a strong, laterally directed spine below center of eye, continuous with ridge at posterior end of lacrimal and immediately followed by a pronounced ridge on the third infraorbital bone that ends in a sharp spine. A single postorbital bone with 3-7 minute spinules. Preopercle with 4 or 5 prominent spines on its posterior margin; the uppermost spine largest in line with those along suborbital ridge, directed posterolaterally, with a prominent supplemental spine immediately anterior to it; second spine, when present, much smaller but sharp, immediately ventral to first; third spine pointing posteroventrally; fourth subequal to third, pointing primarily ventrally; fifth spine rudimentary. Nasal spine relatively short, sometimes bifid or nearly so (right side CAS 90384), or absent (right side of CAS 86532). Opercle with two pungent spines. Preorbital spine, suprarobital spine and postorbital spines present, with supraorbital spine much smaller than others. No small spines or spinules on posterodorsal margin of orbit immediately ventroposterior to postorbital spine. Interorbital ridges relatively weak, not ending in spines. Small, simple cirri usually present behind preorbital and supraorbital spines. Usually 2 coronal spines immediately anterior to occiput (missing in holotype and USNM 396088); one specimen (CAS 86524) with an enlarged coronal spine at the edge of a large "hole" in the cranium and with an additional coronal spine on right side. Tympanic spine prominent, pointed notably laterally, as well as dorsolaterally. Pterotic spine extremely well developed, as large as or larger than parietal spine. Nuchal and parcital spines prominent. Posttemporal with a single spine immediately anterior to that on supracleithrum. Supracleithral spine prominent. Cleithral spine very large, about equal in size to dorsalmost preopercu-

FIGURE 1. Lateral view of *Scorpaenodes rubrivinctus*, holotype (CAS 90384, 100.8 mm SL).

FIGURE 2. Dorsal view of head of *Scorpaenodes rubrivinctus*, holotype (CAS 90384, 100.8 mm SL).

lar spine. Occiput slightly depressed, its anterior margin immediately posterior to the slightly raised supraoccipital commisure, its posterior margin between parietal spines (Fig. 2); anterior margin slightly wider than posterior margin. Minute teeth arranged in 4 or 5 irregular rows on the V-shaped vomer. Palatines toothless or possibly with at most a few scattered teeth. A prominent knob at symphysis of lower jaw; in dorsal view appearing as a rounded knob between widely spaced premaxillary bones. Two separated mandibular lateral-line pores immediately behind symphysis. Gill rakers relatively short, stubby. A well developed slit posterior to posteriormost hemibranch. Pseudobranch with 17-25 filaments. No cirri or tentacles on ventral surface of mandible. Swimbladder present.

FIGURE 3. Coloration of holotype of *Scorpaenodes rubrivinctus*, (CAS 90384, 100.8 mm SL). Photograph was taken soon after its capture and before preservation.

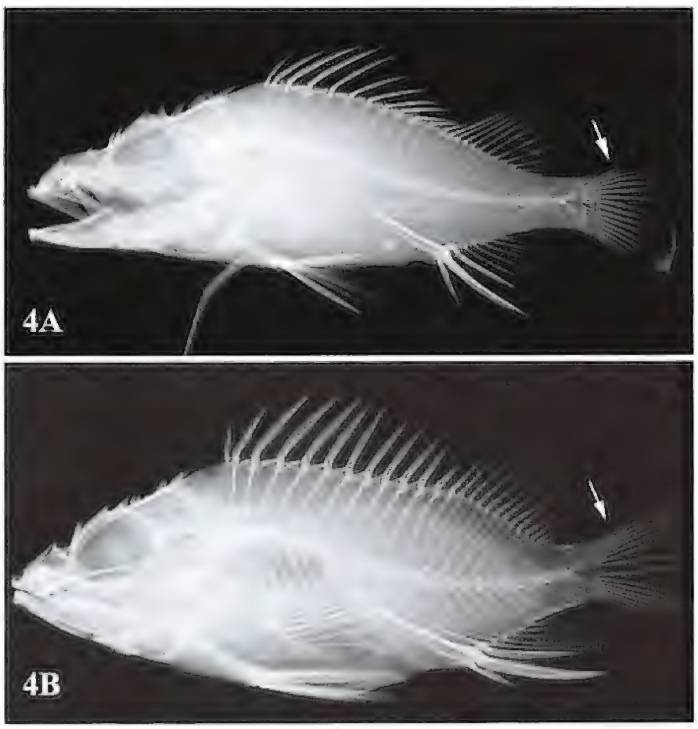

FIGURE 4 A. Radiograph of *Scorpaenodes rubrivinctus* (USNM 396088, paratype). B. Radiograph of *Thysanichthys crossotus* (CAS 47297). Arrows indicate thickened procurrent caudal fin-ray.

Body laterally compressed, deepest between third dorsal spine and pelvic fin. Dorsal fin originating above supracleithral spine; third or fourth spines longest; penultimate shortest; fin membranes between spines notably incised. Anal fin with 3 prominent, slightly curved spines; second longest and thicker than first or third. Pectoral fin with 8-10, usually 9 ventralmost unbranched-rays, 9-10 branched rays in middle of fin, and a single unbranched ray dorsally. Longest ray of pectoral fin (dorsalmost unbranched ray) reaching to base of third anal spine, this ray notably longer than branched rays immediately above. Pelvic-fin spine relatively large, reaching more than half the distance from pelvic-fin insertion to the anal-fin origin. Caudal fin with 5 or 6 branched rays in ventral half and 6 or rarely 7 branched rays in dorsal half.

Color in life (based on field notes for CAS 201803, 100 mm SL paratype, made immediately after capture) pink with orange bars; first bar faint, behind head between first three dorsal spines;

second bar more distinct, beneath dorsal spines VIII-X; third bar distinct, between dorsal soft rays 1-8; fourth bar at base of caudal, extending narrowly onto fin (Fig. 3). Dorsal-fin membrane with orange blotches, soft dorsal with orange at basal 40%, then clear, becoming orange again distally. Anal fin faint orange, with third bar on body extending onto it. Pelvic-fin rays orange, membranes clear. Pectoral-fin rays checkered with orange, membrane clear. Caudal-fin rays orange, membrane clear. Belly and chest pale pink, becoming orange on ventral 40% of body. Body coloration in preservative pale, with several broad dark, rather well marked bars; first bar below first three dorsal spines, short, usually not reaching much below base of dorsal fin; second bar usually more prominent, below dorsal spines 5 or 6 and extending below lateral line almost to ventral midline near anus; third bar even broader and more prominent, extending ventrally from base of last dorsal spine and soft dorsal fin rays to base of anal fin; a fourth dark bar over posterior part of caudal peduncle. Posterior portion of caudal peduncle immediately anterior to caudal-fin base often with five to nine distinct, but relatively minute melanic spots that are sometimes seen in more anterior bars. The holotype and two paratypes (CAS 201883, CAS 86524) with black pigment on membranes between spines 7-11 subdistal to fin margin.

Body Measurements.— Measurements, in mm, followed parenthetically by the %SL, of the holotype and the 7 paratypes in the following order: CAS 90384 (holotype, 100.8 mm SL ♂); CAS 201883 (100.2 mm SL); CAS 86532 (98.9 mm SL ♂); USNM 396088 (88.5 mm SL ♂); CAS 86511 (83.4, 87.7 mm SL 2♀); CAS 86524 (70.9 mm SL ♂). Head length: 45.2(44.8); 47.4(47.3); 45.4(45.9); 41.6(46.9); 41.5(47.3); 39.3(47.1); 32.2(45.4). Snout: 12.8(12.7); 14.3(14.3); 14.7(14.9); 12.4(14.0); 12.9(14.7); 12.2(14.6); 9.7(13.7). Orbit diameter: 11.8(11.7); 12.8(12.8); 12.4(12.5); 12.1(13.6); 11.8(13.4); 11.6(13.9); 8.7(12.3). Interorbital width: 4.0(4.0); 4.7(4.7); 6.2(6.3); 3.7(4.2); 4.0(4.6); 4.3(5.2); 3.5(4.9). Jaw length: 21.3(21.1); 20.1(20.0); 19.9(20.1); 17.9(20.2); 17.7(20.2); 17.6(21.1); 14.5(20.4). Postorbital length: 21.1(21.0); 21.4(21.4); 20.0(20.0); 18.9(21.3); 18.5(21.1); 16.5(19.8); 14.5(20.5). Greatest body depth: 34.3(34.0); 34.0(34.0); 32.6(33.0); 29.3(33.1); 29.7(33.9); 28.5(34.2); 25.1(35.4). Predorsal length: 40.9(40.6); 42.6(42.6); 42.7(48.1); 40.4(45.6); 39.0(44.5); 38.5(46.2); 30.0(42.3). Anal-fin length: 23.8(23.6); 26.2(26.2); 27.2(27.3); 22.7(25.9); 23.3(26.3); 24.8(29.7); 19.8(27.9). Caudal-fin length: 26.6(26.5); 22.7(22.7); 22.6(22.8); 20.5(23.1); 20.3(23.2); 20.9(25.1); 18.4(26.0). Pectoral-fin length: 26.4(26.2); 27.7(27.6); 36.3(36.7); 28.2(31.8); 21.4(24.4); 29.4(35.2); 24.8(35.0). Pelvic-fin length: 20.7(.20.5); 24.5(24.5); 27.1(27.2); 24.3(27.4); 20.9(23.8); 9.5(11.4); 16.8(23.7). First dorsal spine: 7.7(7.6); 7.1(7.1); 7.9(7.9); 7.3(8.3); 8.2(9.4); 7.6(9.1); 4.8(6.8). Second dorsal spine: 13.4(13.3); 9.4(9.4); 12.1(12.2); 11.2(12.6); 12.7(14.5); 12.0(14.4); 8.8(12.4). Third dorsal spine: 17.9(17.8); 16.2(16.2); 17.6(17.8); 14.4(16,3); 17.0(19.4); 16.4(19.7); 13.9(19.6). Fourth dorsal spine: 18.8(18.7); 16.6(16.6); 18.8(19.0); 15.4(17.4); 16.9(19.3); 15.3(18.3); 14.4(20.3). Fifth dorsal spine:16.8(16.7); 10.6(10.6); 16.0(16.2); 13.6(15.4); 14.7(16.8); 13.4(16.1); 12.7(17.9). Penultimate dorsal spine: 5.2(5.2); 6.1(6.1); 6.7(6.8); 6.9(7.7); 6.6(7.5); 4.4(5.3); 4.7(6.6). Last dorsal spine:13.0(12.9); 11.1(11.1); 11.7(11.8); 10.21(11.5); 11.9(13.6); 10.7(12.8); 8.0(11.3). First anal spine: 11.2(11.1); 9.6(9.6); 10.7(10.8); 8.4(9.4); 12.3(14.0); 8.0(9.6); 6.8(9.6). Second anal spine: 20.5(20.3); 19.2(19.2); 20.2(20.4); 17.1(19.3); 19.7(22.5); 17.7(21.2); 14.8(20.9). Third anal spine: 15.9(15.8); 14.8(14.8); 16.3(16.5); 12.9(14.6); 14.5(16.5); 13.6(16.3); 10.9(15.4). Caudal peduncle least depth: 9.4(9.3); 9.1(9.1); 9.1(9.2); 7.4(8.4); 8.5(9.7); 7.6(9.1); 6.9(9.7). Anterior tip of snout to base of second dorsal spine: 43.5(43.2); 44.5(44.4); 44.5(45.0); 41.1(46.4); 39.2(44.7); 40.8(48.9); 31.5(44.4). Snout to base of third dorsal spine: 46.2(45.8); 47.6(47.5); 50.9(51.5); 43.2(48.8); 41.1(46.9); 42.6(51.1); 33.5(47.2). Snout to base of fourth dorsal spine: 49.8(49.4); 51.8(51.7); 51.2(51.8); 46.3(52.4); 47.7(54.4); 45.3(54.3); 36.0(50.8). Snout to base of fifth dorsal spine:54.1(53.7); 55.8(55.7); 54.4(55.0); 49.2(55.6); 48.2(55.0); 49.2(59.0); 39.0(55.0). Distance between tip of fourth dorsal spine and membrane anterior to spine: 10.3(10.2); 10.0(10.0); 10.8(10.9); 8.67(9.8); 10.9(12.5); 8.1(9.7); 8.6(12.1). Distance between snout and pelvic insertion: 40.1(39.8); 44.4(44.3); 46.1(46.6); 40.0(45.2); 38.2(43.6); 33.7(40.4); 32.1(45.3). Distance between base of first and fifth dorsal spines:12.5(12.4); 13.1(13.1); 12.3(12.4); 11.1(12.6); 12.4(14.1); 12.9(15.5); 9.6(13.5). Distance between fifth dorsal spine base and pelvic-fin insertion: 36.2(35.9); 36.3(36.2); 36.5(36.9); 31.8(36.0); 30.5(34.8); 29.9(35.9); 27.6(38.9). Distance between first dorsal spine base

and pelvic fin insertion: 33.8(33.5); 33.8(33.7); 33.8(34.2); 28.6(32.3); 29.0(33.1); 27.6(33.1); 24.5(34.6). Distance between bases of fifth and last dorsal spines: 25.9(36.5); 25.7(25.5); 25.4(29.0); 21.6(24.3); 22.6(22.6); 20.0(20.1); 18.6(18.8). Distance between base of last dorsal spine to base of last dorsal ray: 17.0(16.9); 15.0(15.0); 16.0(16.2); 14.3(16.1); 11.0(12.5); 15.0(18.0); 12.0(16.9). Distance between last dorsal ray and last anal ray: 13.2(13.1); 13.8(13.8); 12.2(12.3); 11.5(13.0); 10.6(12.1); 10.2(12.2); 10.0(14.1). Distance between anal-fin origin and base of last anal ray: 13.6(13.5); 13.4(13.4); 15.0(15.2); 12.7(14.3); 12.74(14.5); 11.0(13.2); 10.8(15.2). Distance between pelvic-fin insertion and anal-fin origin: 35.3(35.0); 33.0(32.9); 29.6(30.2); 27.7(31.3); 28.5(32.5); 26.0(31.2); 25.8(36.4). Distance between base of first dorsal spine and anal-fin origin: 47.4(47.0); 46.3(46.2); 45.9(46.4); 41.5(46.9); 41.6(47.4); 39.5(47.4); 33.2(46.8). Distance between base of last dorsal spine and pelvic-fin insertion: 46.2(45.8); 45.0(44.9); 43.0(43.5); 37.8(42.7); 38.7(44.1); 38.0(45.6); 34.2(48.2). Distance between last dorsal spine and last anal ray: 22.9(22.7); 21.8(21.8); 21.7(21.9); 20.1(22.7); 19.0(21.7); 19.9(23.9); 16.7(23.6). Distance between last dorsal ray and anal-fin origin: 25.1(24.9); 24.0(24.0); 26.9(27.2); 21.6(24.4); 20.5(23.4); 20.4(24.5); 18.4(26.0). Distance between base of last dorsal spine and anal-fin origin: 25.7(25.5); 26.6(26.7); 23.2(26.2); 27.2(27.5); 27.6(31.5); 21.6(25.9); 20.2(28.5). Distance between base of fifth dorsal spine and anal-fin origin: 41.0(40.7); 39.6(39.5); 39.8(40.2); 34.4(38.8); 33.2(37.9); 33.2(39.8); 28.2(39.8).

Etymology.— The specific epithet is derived from the Latin combination *ruber* (red) + *vinctus* (banded), in reference to the color pattern of this species.

Distribution.— The new species was observed and collected from rocky reefs upon the platform and along the margins of the Galápagos archipelago at depths from 200-412 m. It was also observed and photographed by Avi Klopfer, Shmulik Bloom, and John McCosker at Cocos Island, Costa Rica, at depths from 160-300 m. It is not an uncommon species at either location. *Scorpaenodes rubrivinctus* is known from deeper depths than yet reported for other species of *Scorpaenodes*. Four species of *Scorpaenodes* have been described from deep reefs (Eschmeyer 1969a; Eschmeyer and Rama Rao 1972). According to those authors, *S. muciparus* reaches depths of about 380 m in the Solor Straits at 8°27′S,122°54′E (ZMA 110.246). *Scorpaenodes investigatoris* has been taken to depths of 170 m, with the first specimen taken from stomach of a snapper (*Pristipomoides filamentosus*) caught in 200 m (Smith 1958). *Scorpaenodes tribulosus* reaches depths of 140 m. *Scorpaenodes smithi* has been recorded at depths to 110 m (BMNH 1933.8.11.4). Other species of *Scorpaenodes* occur inshore at shallower depths, with *S. albaiensis* being taken from 1.5–85 m, *S. littoralis* to about 40 m (SAIAB 59759), and *S. minor* from 0–38 m. Nakabo (2002) reported *Thysanichthys crossotus* as occuring between 120 and 130 m.

To our knowledge this is the first report of a species of *Scorpaenodes* being collected by a submersible. Submersible dives were made across much of the Galápagos archipelago in a variety of habitats to a depth of 1000 m. The new species was observed between depths of 203-412 m during five submersible dives. It was typically found along steep volcanic slopes (60°-90°) that were not burdened with sediments. The fish were most abundant between 260-290 m and often associated with or residing upon rossellid sponges (Fig. 11), an association that collections data suggests may also be true for *S. smithi*. The fish were seen alone or in close proximity to each other, but were never observed to interact. With collection of the type series and with underwater observation of this species at Cocos Island (Fig. 12), *S. rubrivinctus* provides another example of the close association of the fish fauna of the Galápagos and Cocos Islands. Future use of submersibles is likely to greatly increase our understanding of this and other benthic deep reef species.

Species comparisons.— *Scorpaenodes rubrivinctus* is readily distinguished from *S. xyris*, the only other species of *Scorpaenodes* in the eastern tropical Pacific in having 47–51 vertical scale rows (39–47 in *S. xyris*), and a distinctly barred rather than variegated or somewhat more marmorated color pattern as seen in most shallow water species of *Scorpaenodes*. It can be readily distinguished from most other species of *Scorpaenodes* by its elongate snout (12.6-14.8% SL) *vs.*

(9.3–13.1%SL), except *S. albaiensis* and *S. minor* (Figs. 5A, 5B; Tables 3 and 4), which also exhibit elongate snouts (9.3–14.2% SL). The presence of wide, orange-red bars, and the head spination (Figs. 2, 6A) serve to distinguish it from all other *Scorpaenodes* species having bars, except perhaps *S. muciparus*. Although the fresh coloration of *S. muciparus* is unknown and the bars are known only from those observed in two drawings (see discussion below), *S. rubrivinctus* can be readily distinguished from it by its much longer snout, more elongate dorsal fin-spines, less numerous vertical scale rows (70-73 in *S. muciparus*) and longer anal fin spines. In the deep-water species *S. investigatoris* and *S. smithi,* like the shallow water *S. albaeinsis* and *S. minor*, the margins of the vertical bars are rather irregular and typically not well defined in adults. However, it should be noted that juveniles of *S. albaiensis* are notably more distinctly barred, like *S. rubrivinctus*, than are adults. Additional study of other *Scorpaenodes* species is needed to establish if this represents paedomorphosis. Unfortunately, juveniles of most species of *Scorpaenodes,* although often numerous, are extremely difficult to identify and pigmentation in preserved material typically fades with time.

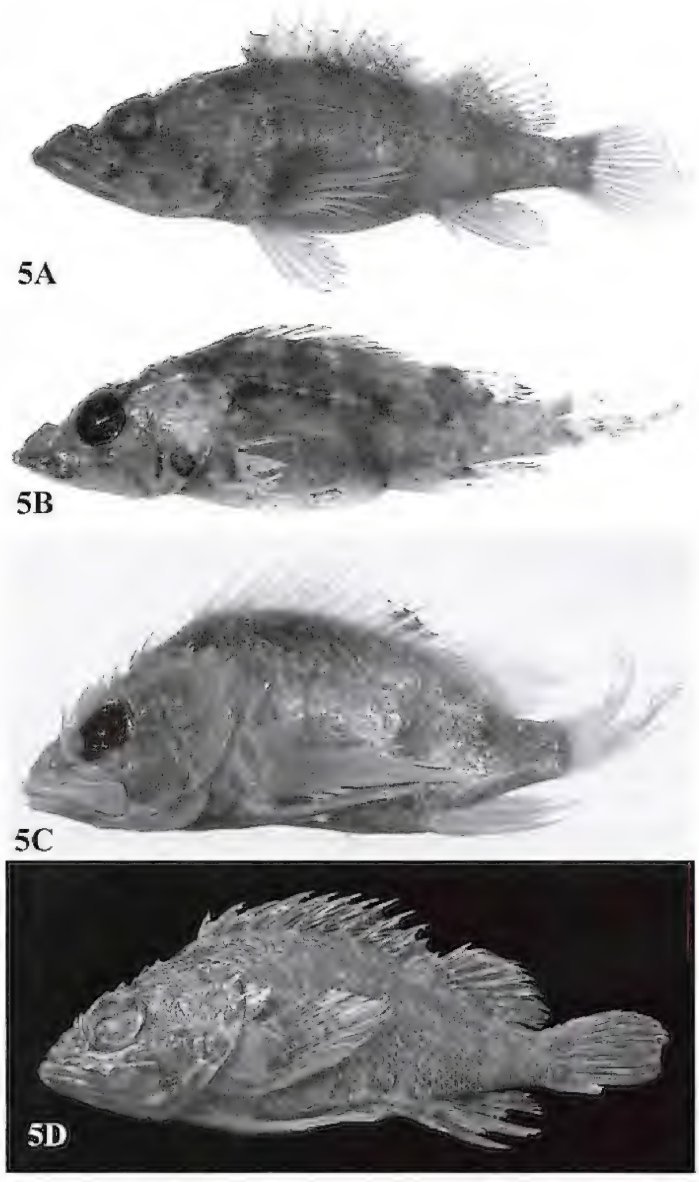

FIGURE 5. A. *Scorpaenodes albaiensis* in lateral view (CAS 75357). B. *Scorpaenodes minor* in lateral view (CAS 214156). C. *Thysanichthys crossotus* in lateral view (CAS53360). D. *Thysanichthys evides* (FMNH 57082, holotype, 74.4 mm SL).

As can be noted in Table 1 (see Appendix), *S. rubrivinctus* has relatively small scales in 47–51 vertical scale rows (38–43 in *S. albaiensis*; 30–37 in *S. minor*; 39–40 in *S. investigatoris*; 33–46 in *S. littoralis*; 35 -43 in *S. smithi*; 33-46 in *S. tribulosus*) and a relatively high pectoral fin-ray count: 18–20 (14–17 in *S. albaiensis;* 14–16 in *S. minor*; 19 in *S. investigatoris*; 17-19 in *S. littoralis*; 17–18 in *S. smithi*; 18-19 in *S. tribulosus*).

The new species is similar to *Thysanichthys crossotus* Jordan and Starks, 1904, in a number of

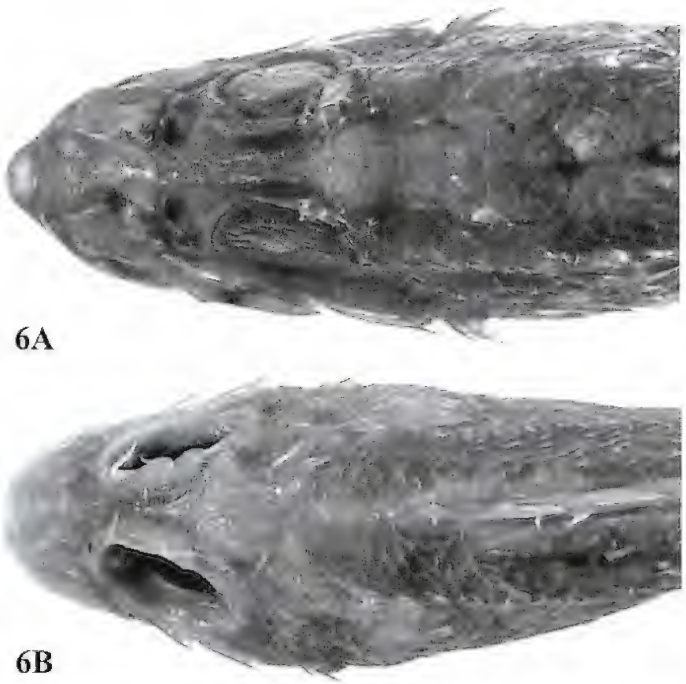

FIGURE 6. A. Dorsal view of head of *Scorpaenodes albaiensis* (CAS 75357). B. Dorsal view of head of *Thysanichthys crossotus* (CAS 53360).

respects, including shape of the first three infraorbital bones, the shape and size of many cranial spines (Fig. 6B), the shape of the pectoral fin (Fig. 5C), and in body proportions (Fig. 5C, Figs. 7 and 8). However, *T. crossotus* differs in possessing 2 postorbital bones (infraorbitals 5 and 6) (Mandrytsa 1991 and 2001) *vs.* 1 in *S. rubrivinctus*, 15–17 pectoral fin-rays (*vs.* 18–20), a dorsal fin formula of XIII, 11½ (*vs.* XIII, 8½–10½ in *S. rubrivinctus*), 10 + 15 = 25 vertebrae (*vs.* 9 + 15 = 24), a deeper body (38.7-39.9% SL *vs.* 33–35.4%), a slightly longer second anal spine (23–26% *vs.* 19-22.5%) (see Fig. 7H; Tables 2 and 5), a less developed ridge at the base of each opercular spine that is not much raised from the lateral surface of the opercle and in having dermal filaments along its head and lateral line. *Scorpaenodes rubrivinctus* also differs from *T. crossotus* in having a much longer upper preopercular spine, an enlarged pterotic spine and a moderately enlarged lower posttemporal spine. It also differs from *T. crossotus* in having the ridge of the posterior (second) spine on the third infraorbital bone (suborbital 2) relatively in line with the ridge of the more anterior spine, rather than distinctly offset ventral to it. In this respect it is more similar to *S. littoralis*, *S. albaiensis*, *S. minor* and the types of *T. evides*, as well as several other species of *Scorpaenodes*. It differs from the paratypes of *T. evides* in having a slightly, but significantly larger head (44.4–47.3% SL *vs.* 40.9–42.2% SL in *T. evides*; Tables 1, 4). It differs from both *T. crossotus* and *T. evides* in having a longer snout (13-15% SL *vs.* 10.8–11.5%SL in *T. crossotus* and 9.8–10.5%SL in *T. evides*).

GENERIC ASSIGNEMENT WITH REMARKS ON LIMITS OF *SCORPAENODES* AND *THYSANICHTHYS*.—*Scorpaenodes* Bleeker, 1857, contains 27 valid species, but has not been revised on a world-wide basis. Eschmeyer (1965) discussed the limits of *Scorpaenodes* and consigned *Sebastopsis* Gill, 1862, *Setastopsis* (not of Gill) Sauvage, 1873, *Hypomacrus* Evermann and Seale, 1907, *Sebastella* Tanaka, 1917, *Metzelaaria* Jordan, 1923, *Parascorpaenodes* Smith, 1957, and *Paronescodes* Smith, 1958 to its synonymy, noting that all differed from other members of the Scorpaeninae, except *Hoplosebastes* Schmidt, 1929, in having the combination of normally 13 dorsal spines and no palatine teeth. This contrasts with the diagnosis of *Thysanichthys* given by Jordan and Starks (1904), who distinguished the genus as having 13 dorsal spines, palatine teeth, dermal filaments on the head and lateral line, no enlarged preopercular spine or ridge on opercle, and more well-developed spines on the head and suborbitals. Eschmeyer's conclusion has been followed by most subsequent authors, although Mandrytsa (2001), resurrected *Hypomacrus*, thus following earlier workers (Herre 1952, 1953; Smith 1957, 1958;.and Schultz 1966).

Although aspects of cladistic methodology employed in the work of Mandrytsa (2001) render some of his conclusions difficult to assess (Imamura 2004; Motomura, Sakurai, and Shinohara 2009), Mandrytsa did examine 13 species, one unidentified, as part of a cladistic study that focused primarily on the diversification of the cephalic lateral line. Mandrytsa concluded that *Hypomacrus* forms the sister-group to species of *Scorpaenodes* and the monotypic *Hoplosebastes*, but did not otherwise discuss intra-generic relationships among species of *Scorpaenodes*. Mandrytsa used six characters to infer the relationships between *Hypomacrus* and species of *Scorpaenodes*. Of these, five are based the presence of various discontinuities between branches of the cephalic lateral line, which he regarded as relatively apomorphic to the plesiomorphic condition seen in *Scorpaenodes* and some other Scorpaenidae in which these branches are completely confluent. The apomorphic condition of several of these characters appear in other more distantly related genera and subfamilies (eg. *Phenacoscorpius*, *Idiastion*, Setarchinae and Pteroinae), suggesting that the presence of such discontinuities may not be uniquely derived. Additionally, his single specimen of *S. minor* was relatively small (25 mm SL) and the development of the cephalic lateral line among many species of Scorpaeninae can change during ontogeny, typically becoming more bifurcate and interconnected with increasing size. Mandrytsa noted only a single character that he regarded as relatively apomorphic in species of *Scorpaenodes* as compared to species of *Hypomacrus* — pleural ribs beginning on the sixth rather than the fifth vertebra as observed in *S. albaiensis* and *S. minor*, a condition likewise seen among the Pteroinae. In *S. rubrivinctus* and in *T. crossotus*, the first pleural ribs begin on the fifth vertebra.

Other pertinent cladistic studies (Ishida 1994; Imamura 2004; Shinohara and Imamura 2007) and molecular phylogenetic studies (Smith and Wheeler 2004) have included too few species of *Scorpaenodes* and its near relatives to be informative as to the limits of the genus, with existing cladistic studies having reached substantially different conclusions with respect to the relationships of *Scorpaenodes* and its various potential sister-taxa.

Ishida (1994) placed *Scorpaenodes* as a sister group to *Hoplosebastes* and the Pteroinae and widely removed from *Trachyscorpia,* which he regarded as the sister-group to *Plectrogenium*. He considered the latter two genera as forming the sister group of the Sebastinae, which he elevated to family status, a conclusion widely followed. Ishida did not examine *Thysanichthys*. Imamura (1996) recognized *Scorpaenodes* as a member of an undifferentiated bush including species of *Dendrochirus*, *Scorpaena*, *Scorpaenopsis*, *Pontinus*, *Trachyscorpia*, and *Setarches*. Within an analysis of the Scorpaenidae that included other scorpaenoids, Mandrytsa (2001, Fig. 225) concluded that *Scorpaenodes* was one of 8 lineages of an undifferentiated bush at the base of the family, with *Hoplosebastes* the member of another lineage, and *Hypomacrus* forming a separate lineage including *Idiastion* and *Phenacoscorpius,* which together form a sister group to the genera *Neoscorpaena*, *Trachyscorpia*, *Setarches*, *Ectreposebastes*, and *Lioscorpius*. However, an analysis of relationships within the Scorpaenidae, exclusive of other scorpaenoids, led Mandrytsa (2001, Fig. 235) to conclude that *Scorpaenodes* is the sister group of *Hoplosebastes*. He considered them to form the sister group of *Hypomacrus*, while *Trachyscorpia* was recognized as the sister group of a clade composed of *Idiastion* and *Phenaocoscorpius*. Mandrytsa concluded that *Thysanichthys* forms the sister-group to a clade comprising the following genera: *Adelosebastes*, *Hozukius*, *Helicolenus*, *Sebastiscus* and *Sebastes*. In contrast, Imamura (2004) placed *Scorpaenodes* as the sister group to the Pteroine genera *Pterois* and *Dendrochirus* and regarded this clade as the sister group of a clade containing *Pontinus*, *Trachyscorpia*, *Setarches*, and *Ectreposebastes,* with both of these clades the sister group to *Taenianotus*. Completing representatives of the Scorpaeninae Imamura considered *Scorpaenopsis* as the next most proximate sister taxon to the combined clade, with *Scorpaena* representative of the next most ancestral sister lineage. Imamura concluded that all scor-

paenoid clades are derived from a paraphyletic assemblage of species encompassing a loosely defined Sebastidae into which he tentatively placed *Thysanichthys*, although he did not examine species of *Thysanichthys* or *Hoplosebastes armatus*.

The molecular results of Smith and Wheeler (2004) embedded *Scorpaenodes scaber* in a clade of the Scorpaeninae, between *Scorpaenopsis macrochir* and three representative species of *Scorpaena*, and placed an unidentified species of *Thysanichthys* in a separate clade between *Trachyscorpia cristulata* and the sebastid genera *Helicolenus* and *Sebastes*. Unfortunately, the specimen identified by Smith and Wheeler as *Thysanichthys* sp. can not be located to verify its identity.

Although cladistic analysis and revision of *Scorpaenodes* and *Thysanichthys* and their near relatives is beyond the scope of this work, a number of observations pertinent to the generic placement of *Scorpaenodes rubrivinctus* are warranted. Our investigation suggests that the limits of these genera are poorly defined from a cladistic perspective and that *S. rubrivinctus* exhibits character combinations observed in several scorpaenid genera, most notably *Scorpaenodes*, *Thysanichthys* and *Hoplosebastes*. Although the unique combination of counts and measures in the new species suggest it may be more closely related to some species of *Scorpaenodes* than others, appropriate interpretation of various similarities in spination and morphometrics within a cladistic context is needed. Data from other species of *Scorpaenodes* are also needed before its relationships can be elucidated.

Subsequent to Eschmeyer (1965), the combination of 13 dorsal spines and the absence of palatine teeth has been widely employed to diagnose species of *Scorpaenodes*. However, this combination is also characteristic of species of the subfamily Pteroinae. Although 13 dorsal spines typically characterize *Scorpaenodes* and the Pteroinae and distinguish included species from those in the Scorpaeninae, which almost always bear 12 spines, specimens of *Scorpaenodes* species with 12 spines and Scorpaeninae species with 13 spines are observed infrequently. As discussed by Randall and Poss (2002), palatine teeth have been lost in multiple scorpaenoid lineages and their absence does not represent a uniquely derived character state.

The pectoral fin of *S. rubrivinctus* has the unusual shape also seen in *T. crossotus*, *S. albaiensis* and *S. minor*. In these species, the dorsalmost unbranched rays are abruptly longer than the ventralmost branched rays, a feature poorly figured in the original description of *T. crossotus*. A similar, but not as marked, discontinuity in fin-ray lengths is observed in other species of *Scorpaenodes* and in *T. evides*.

The presence of dermal filaments was used to originally diagnose *Thysanichthys*. However, a number of species of *Scorpaenodes*, most notably *S. hirsutus*, but also *S. albaiensis* and *S. minor* bear small, simple filamentous cirri on the head and body, as do species of *Thysanichthys*.

Besides *T. crossotus*, *T. evides* is the only other species in *Thysanichthys*. Late in this study, we included data for the five paratypes of *Thysanichthys evides* , as well as an additional specimen found in the lot containing the paratypes (SU 22611), but not designated as a paratype in the original description. Our analyses strongly suggest that *T. evides* is the senior synonym of *Scorpaenodes littoralis* Tanaka 1917. However, we are reluctant to formally reach such a conclusion without first examining the holotypes of *S. littoralis* (ZUMT 7439) and *T. evides* (FMNH 57082). Nonetheless, we note that with exception of but one measure, the paratypes cannot be distinguished from specimens identifiable as *S. littoralis* based on our data (Figures 2A, 2B; Tables 4, 10 [see Appendix]). Examination of a photograph and a radiograph of FMNH 57082 made available to us by the Field Museum (Fig. 5D) likewise fail to suggest notable differences between the nominal forms. W. Leo Smith informs us that palatine teeth are absent in the holotype of *T. evides*. Our data indicate that the paratypes of *T. evides* differ from material identified as *S. littoralis* only in the depth of the caudal peduncle ($P < 0.05$). However, none of our comparative materials of

S. littoralis are from Japan and this difference may reflect possible geographic variation within *S. littoralis*. Because Tanaka's name is in wide use, whereas that given by Jordan and Thompson has apparently been only used once (Matsubara, 1943; who explicitly mentions both species), we believe that such a potentially disruptive nomenclatural change should be made only after the holotypes and more extensive holdings of *S. littoralis* can be studied.

Although palatine teeth are present in *Hoplosebastes armatus* and *Thysanichthys crossotus*, these species also share with all species of *Scorpaenodes* and all members of the Pteroinae the presence of a prominent, spine-like, somewhat elongate and somewhat thickened unsegmented procurrent ray immediately dorsal to the dorsalmost segmented caudal fin ray. This procurrent ray is not particularly spinous, elongate, or thickened in other scorpaenoids. Among species that exhibit this condition, it is less developed in *Thysanichthys crossotus* and is typically more elongate and slender, yet distinctly pungent among pteroine species. If interpreted as a synapomorphy, the presence of this relatively hypertorphied, spinous, unsegmented procurrent-ray provides additional support for the recognition of clade K1 of Ishida (1994) or clade 10A of Imamura (2004), but also suggests the inclusion of *Thysanichthys*, which was not studied by either author. It also supports Ishida's and Mandrytsa's recognition of a relatively close relationship between *Hoplosebastes* and *Scorpaenodes*. Interestingly, many pteroines exhibit notable expansion and modification of bones in the region of the snout, with *Dendrochirus biocellatus* being notably similar to *S. rubrivinctus* in the shape of the head, body, and median fins.

Species of *Scorpaenodes, Thysanichthys* and *Trachyscorpia* (but not *Hoplosebastes*) all have relatively short rounded lobes on the ventral margin of the lacrimal, the posteriormost being slightly pointed in larger specimens. Although the anterior lobe is rounded in *S. rubrivinctus*, the second and third "lobes" are somewhat more pungent. This contrasts with nearly all other non-sebastid scorpaenoids, which usually bear distinct, pungent lacrimal spines. Among the Sebastidae (Sebastinae of some authors), the ventral margin of the lacrimal is usually largely devoid of distinct spines (except *Hozukius*), whereas in the Pteroinae the ventral margin can be relatively spineless or may lobed and bear numerous small spinules that increase in number with size.

Scorpaenodes rubrivinctus, like all other species of *Scorpaenodes*, Pteroninae, and *Setarchinae*, has a large cleft posterior to the posteriormost hemibranch. Among other Scorpaeninae, species of *Pontinus* have a small slit or cleft as do some species of *Neomerinthe* and *Phenacoscorpius*. This contrasts with the condition seen in *Thysanichthys* and most species of the Scorpaeninae in which this slit is absent at any size. In species of *Trachyscorpia* this cleft is present in smaller individuals, but is closed or absent in larger individuals.

Because of the presence of a heterogeneous assemblage of both relatively deep and shallow water species of *Scorpaenodes*, because of the substantial discordance between proposed relationships derived from molecular data and morphological data, and because of character incompatibility and size-related variation among some presumptively or potentially apomorphic states of the morphological characters discussed above, the relationships of species presently included in *Scorpaenodes* and *Thysanichthys* require further study before the phylogenetic relationships of *S. rubrivinctus* and its generic placement can be confidently established.

Morphometrics.— There are a number of morphometric differences that distinguish *S. rubrivinctus* from other species of *Scorpaenodes* and *Thysanichthys* (Tables 2–8 [see Appendix]; Figure 7A–O). Of these, only 4 measures reveal significant differences in slopes among the species compared. *Scorpaenodes investigatoris* shows more rapid growth of the predorsal length relative to SL than do *S. rubrivinctus* and other species compared. The caudal fin of *T. crossotus* appears to grow more rapidly relative to SL than it does in *S. rubrivinctus* or in other species compared, although its significance is based on only 3 specimens. A slightly more positive allometry in the

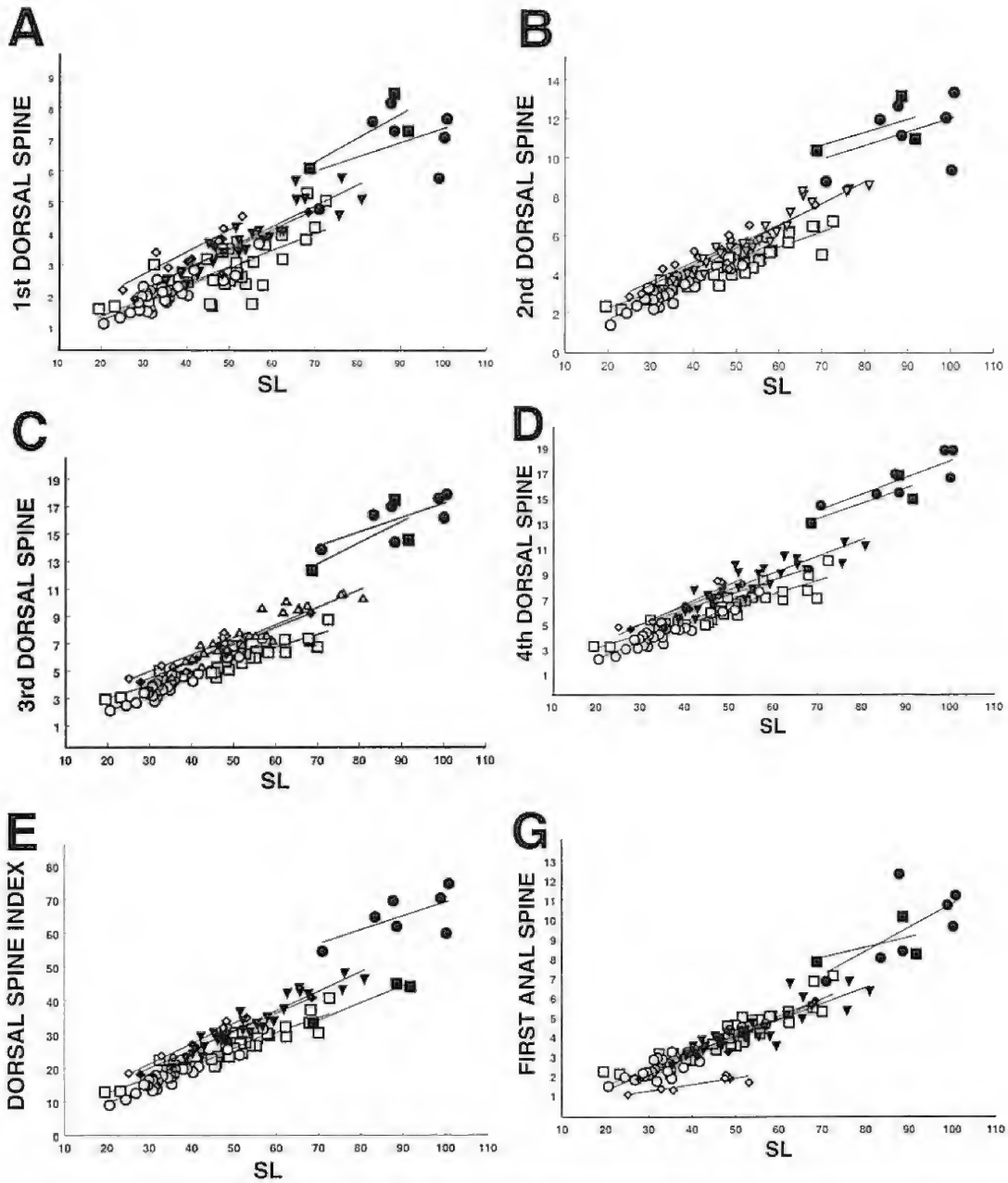

FIGURE 7. Regressions against SL for measurements that distinguish select species of *Scorpaenodes* and *Thysanichthys*. A – First Dorsal Spine. B – Second Dorsal Spine. C – Third Dorsal Spine. D – Fourth Dorsal Spine. E – Dorsal Spine Index (D1 + D2 + D3 + D4 + D5)/SL. F – Incision of Fin-Membrane at Fourth Dorsal Spine. G – First Anal Spine. H – Second Anal Spine. I – Snout to Pelvic-Fin Insertion. J – Penultimate Dorsal Spine. K – Fifth Dorsal Spine to Pelvic-Fin Insertion. L – Pelvic Fin-Insertion to Anal-fin Origin. M – Base of First Dorsal Spine to Anal-fin Origin. N – Base of Fifth Dorsal Spine to Anal-fin Origin. O – Base of Last Dorsal Spine to Base of Last Anal Ray. *S. rubrivinctus*–filled circles; *S. albaiensis* – empty squares; *S. littoralis* – inverted empty triangles (apex down); *S. minor* – empty circles; *S. smithi* – empty diamonds; *Thysanichthys crossotus* – filled squares; *T. evides* – filled diamonds (paratypes). All lengths are in mm.

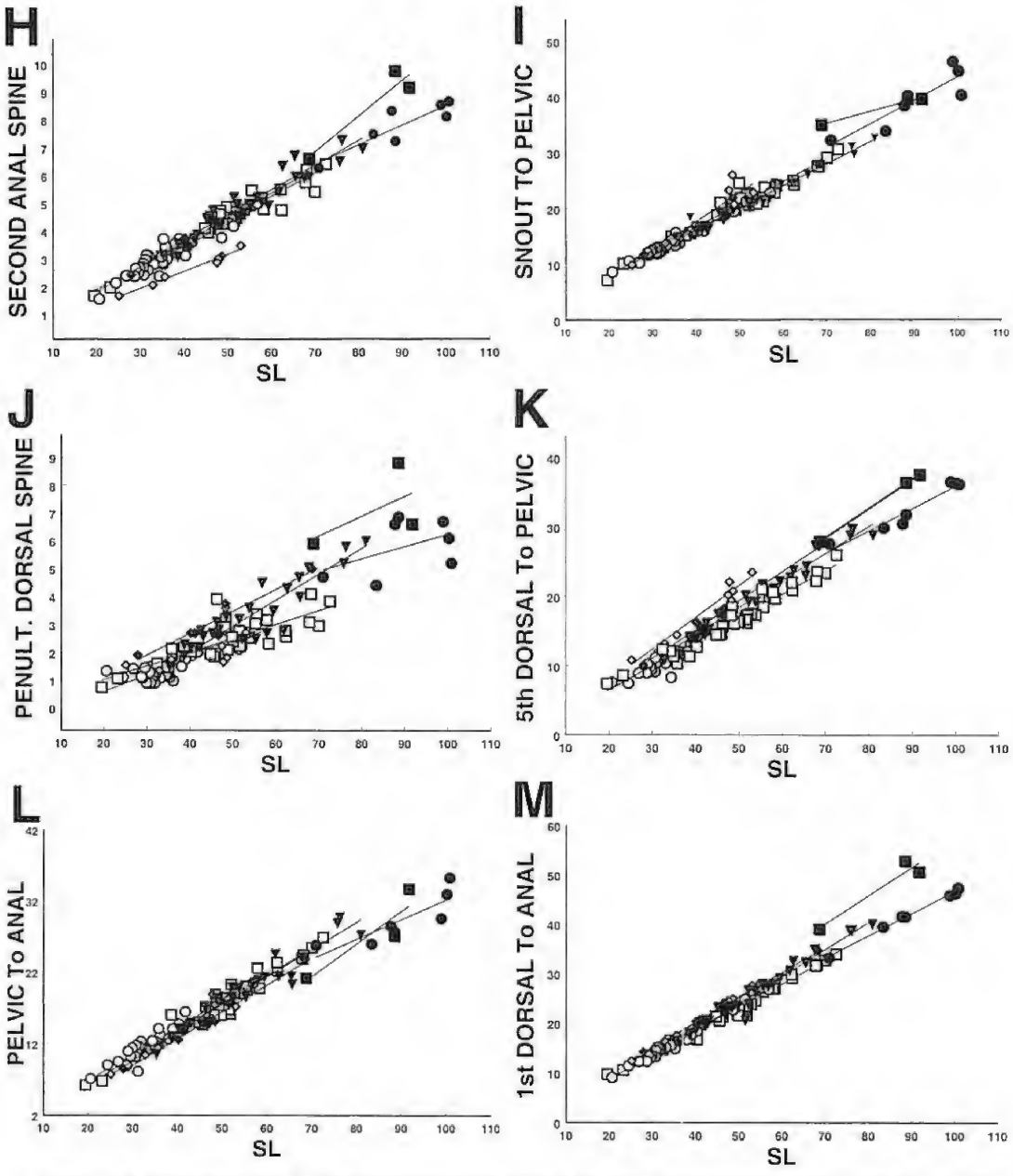

FIGURE 7. Regressions against SL for measurements that distinguish select species of *Scorpaenodes* and *Thysanichthys* (continued; see p. 245 for legend).

length of the pectoral fin relative to SL is observed in *T. crossotus* than in any of the other species examined. The incision of the dorsal fin at the fourth dorsal spine *vs*. SL shows positive allometry in *S. smithi* as compared to other species examined, including *S. rubrivinctus*.

For all other measured variables no significant differences in slope relative to SL were observed among species, with a pooled parallel slopes model of regression providing the best fit for our data. Numerous species exhibited significant differences from *S. rubrivinctus* in Y-intercept when compared under a parallel slopes model (Tables 2-8).

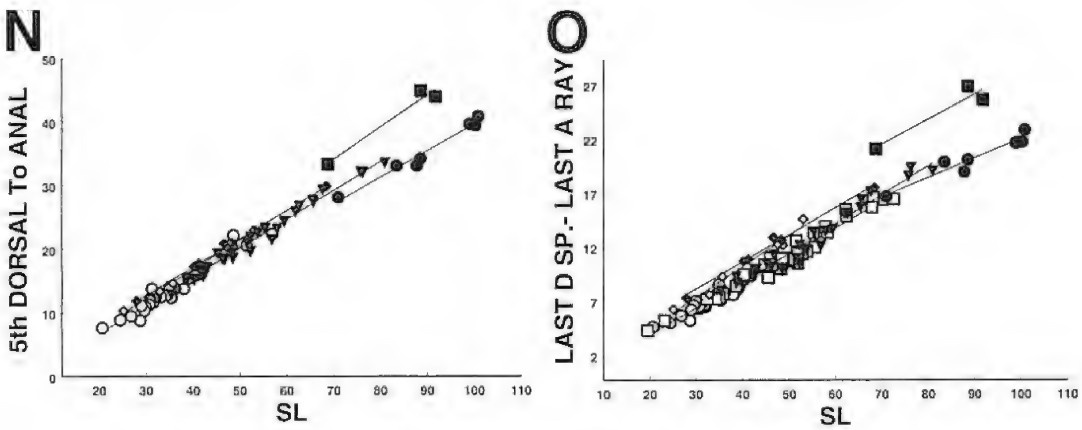

FIGURE 7. Regressions against SL for measurements that distinguish select species of *Scorpaenodes* and *Thysanichthys* (continued; see p. 245 for legend).

Each of the anteriormost 5 dorsal spines is longer at a given size in *S. rubrivinctus* than in other species of either *Scorpaenodes* or *Thysanichthys* (Fig. 7A–7D). Although the differences are slight (Fig. 7A-D), this is more readily apparent if the total lengths of the first 5 dorsal spines are added and their sum regressed against standard length (Fig. 7E). *Scorpaenodes rubrivinctus* has a more deeply incised dorsal fin membrane, as measured from the tip of the fourth dorsal spine to the membrane (Fig. 7F). Like *T. crossotus*, *S. rubrivinctus* has a relatively long first anal spine, which is notably longer than that seen in *S. smithi* (Fig 7G). However, the second anal spine of *S. rubrivinctus* is shorter than that of *T. crossotus*, but not significantly different in length from those seen in other species of *Scorpaenodes* compared, except *S. smithi* (and likely *S. investigatoris, S. tribulosus* and *S. muciparus* as materials become available). *Scorpaenodes rubrivinctus* has a slightly greater distance between the tip of the snout and the pelvic-fin insertion (Fig. 7I) than other species of *Scorpaenodes.* It differs from *T. crossotus* in having a shorter penultimate dorsal spine that is more typical of other species of *Scorpaenodes* (Fig. 7J). The distance between the base of the fifth dorsal spine and the pelvic-fin insertion is greater than observed in either *S. albaiensis* or *S. minor*, and less than in either *S. smithi* or *T. crossotus,* but not significantly different from that seen in *S. littoralis* (Fig. 7K). In contrast, the distance from the base of the first dorsal spine to the origin of the anal fin is as short as it is in *S. albaiensis* and *S. minor*, but slightly yet significantly shorter than that in *S littoralis* or *S. smithi*, as well as distinctly less than that in *T. crossotus* (Fig. 7K). In *S. rubrivinctus* the distance between the pelvic-fin insertion and anal-fin origin is proportionally the same as in *S. albaiensis* and *S. minor*, but slightly less than that observed in other species of *Scorpaenodes* examined (Fig. 7L). *Scorpaenodes rubrivinctus* also has the same proportional distance between the base of the first dorsal spine and the anal-fin origin as observed in *S. albaiensis* and *S. minor*, but significantly, albeit only slightly less than other species of *Scorpaenodes* compared, and notably less than observed in *T. crossotus* (Fig. 7M). The distance between the fifth dorsal spine and the anal-fin origin (Fig. 7N) is relatively shorter in the slender-bodied *S. rubrivinctus*, when compared to *S. albaiensis*, *S. minor* and *S. littoralis*, to the distinctly deeper bodied *S. smithi,* or to the much deeper-bodied *T. crossotus*. In contrast, the distance between the base of the last dorsal spine and the base of last anal ray relative to the SL is relatively less in the new species than in *S. smithi* and also much less than in *T. crossotus* (Fig. 7O). Two unexpected contrasts shows that the distances between the tip of the snout and the bases of the second and third dorsal spines are slightly shorter in *S. albaiensis* than in either *S. rubrivinctus* or *S. minor.*

Principal Component Analyses.— When the measured variables are considered simultaneously using a size-corrected PCA their joint distributions reflect the distinctiveness of *S. rubrivinctus* from most other *Scorpaenodes* species. Although notably more slender in several measures of body depth, the new species is otherwise more similar to *Thysanichthys crossotus* in median-fin spine lengths than to other species of *Scorpaenodes* (Fig. 8). In particular, the elongate anal-fin spine lengths of *S. rubrivinctus* contrast markedly to the condition observed in other deep-reef species of *Scorpaenodes* in which they are relatively short. If specimens of *Hopolosebastes armatus,* which has greatly reduced anal-fin spines, are added to the morphometric ordination (not shown), they do not fundamentally alter the eigenstructure of the result and also plot in the same quadrant as specimens of *S. investigatoris*, *S. smithi* and *S. tribulosus*, although as even more distinctive outliers. The variables discussed above largely account for the clear separation within the ordination, as can be seen from the loadings of the size-adjusted principal components (Table 9).

The PCA derived from counts (Fig. 9; Table 10) shows a comparable result. However, there is a notable step-wise grouping of individuals nearly along the axis of the second eigenvector that results from the discrete distribution of values for a single variable (total dorsal-fin spines) with a high loading on this axis. Despite the presence of such artificial discontinuity, several disjunctions can be observed among the joint distributions of the variables.

Thysanichthys crossotus is separated from the other taxa studied by an unusual combination of more dorsal-fin rays, fewer pectoral fin-rays, and higher scale counts. That *S. albaiensis* and *S. minor* differ significantly in vertical scale counts is immediately apparent, and the combination of fewer scales and fewer pectoral-fin rays distinctly separate both from *S. rubrivinctus*. *Scorpaenodes rubrivinctus* is marginally disjoint in its combinations of counts from those observed in other deeper

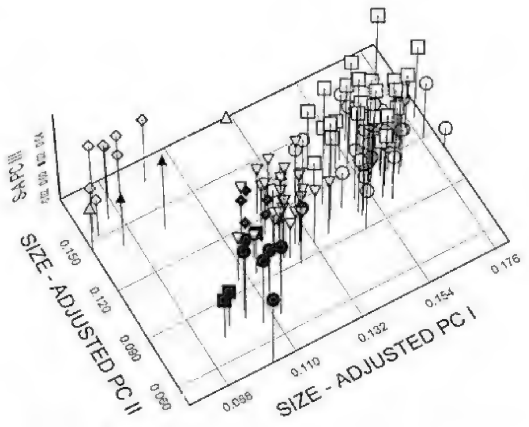

Figure 8. Plot of largest 3 size-adjusted principal components, explaining 51.3% of the residual variance remaining after size-related variation, accounting for 91.8% of total variation, has been removed. *S. rubrivinctus*–filled circles; *S. albaiensis* – empty squares; *S. littoralis* – inverted empty triangles (apex down); *S. minor* – empty circles; *S. investigatoris* – filled triangles (apex up); *S. smithi* – empty diamonds; *S. tribulosus* – empty triangles (apex up; fin-spines of 3 known specimens in relatively poor condition); *Thysanichthys crossotus* – filled squares; *T. evides* – filled diamonds (paratypes). Loadings for most significant original variables contributing to each of the first three size-adjusted principal components are given in Table 9, with select original variables plotted against SL in Fig 7A-O. PC I accounts for 24.2%, PC II – 17.7% , and PC III – 9.5% of total residual variance after size adjustment respectively.

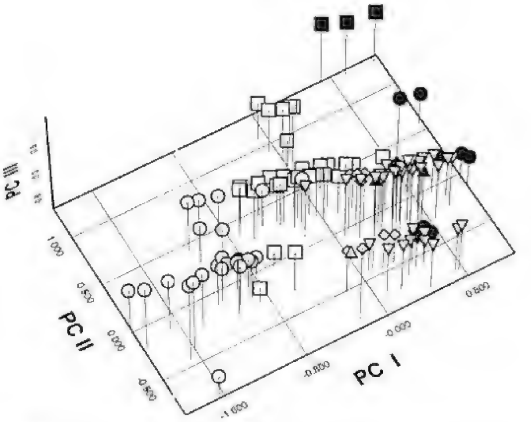

Figure 9. Plot of largest 3 principal components, explaining 88.3% of total observed variation in counts data (PC I – 58.0%; PC II – 18.5%; PC III – 11.8%). Symbols are as given in Figure 8. Factor loadings are given in Table 11.

water species (*S. investigatoris*, *S. smithi* and *S. tribulosus*). In contrast, the combination of counts observed in *S. littoralis* notably overlaps that seen in *S. rubrivinctus*, *S. albaiensis* and the group of deeper reef *Scorpaenodes*.

Although these results seem to suggest that the deeper reef species, including *S. rubrivinctus*, may not all belong to a single lineage, the combinations of counts in other species of *Scorpaenodes* require more rigorous testing before firm conclusions can be reached. Especially important will be the inclusion of additional materials of deeper reef species. The status of the poorly known *Scorpaenodes muciparus* emphasizes the importance of further study. This species was originally described as having a dorsal count of XIII, 9½, a very high vertical-scale row count (70), 18-19 pectoral-fin rays, and apparently relatively strong vertical bars, similar to those observed in *S. rubrivinctus*. The figure published in the original description (Alcock 1889) shows a dorsal count of XIII, 10½, moderately elongate anal-fin spines, and a scale count that appears to approach about 50–60. However a later, more detailed figure (Fig. 10) that matched the original description was subsequently published by Alcock (1898). Although Eschmeyer and Rama Rao (1972) did not discuss this discrepancy nor did they provide additional counts or measures that could be used to assess joint distributions of counts with those in *S. rubrivinctus*, they did report three additional specimens identified as *S. muciparus*, not yet seen by us, and were able to confirm a scale row count of 70-73 on a specimen previously reported in Weber and deBeaufort (1962) as having 45-58 scales. Specimens of *Hoplosebastes armatus* have between 51 and 65 vertical scale rows.

The new species appears to grow relatively large for a species of *Scorpaenodes*, with our largest specimen measuring 100.8 mm SL. The largest known species of *Scorpaenodes* is *Scorpaenodes muciparus*, which reaches 146 mm SL (Eschmeyer and Rama Rao 1972; based on ZMA 110.246). To date, the largest specimens of *S. albaiensis* and *S. minor* examined by us

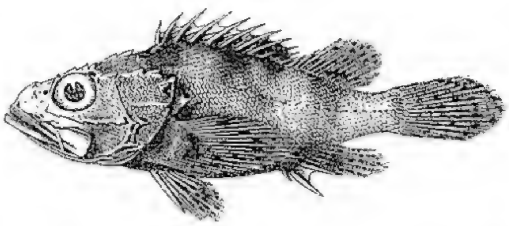

FIGURE 10. *Scorpaenodes muciparus* (Alcock 1889) as figured in Alcock (1898).

FIGURE 11. *Scorpaenodes rubrivinctus* associated with a rosselid sponge, photographed from submersible *Johnson Sea-Link* at 270 m off Seymour Island, Galápagos.

FIGURE 12. Photograph of *Scorpaenodes rubrivinctus* taken at Cocos Island during a submersible dive at 200 m, by *Undersea-Hunter/Deep-See*.

are 72.0 and 51.4 mm SL respectively, although Motomura, Sakurai, and Shinohara (2009) report a 78.5 mm specimen of the former from Okinawa (KAMUM-I 6429). Kuiter and Tonozuka (2001) reported *S. albaiensis* attains 120 mm TL or about 96 mm SL based on unspecified material. Larger species of *Scorpaenodes* include: *Scorpaenodes guamensis* (Quoy and Gaimard, 1824), which reaches about 85 mm SL (CAS 62573), although it may grow to about 112 mm SL (Leiske and Myers 1994; based on unspecified material 140 mm TL); *Scorpaenodes carribaeus* Meek and Hildebrand, 1924, attains about 85 mm SL (Eschmeyer 1969b, but largest specimen unspecified); *Scorpaenodes elongatus* Cadenat, 1950 (150 mm SL, Eschmeyer and Dempster 1990), *Scorpaenodes immaculatus* Poss and Collette, 1991, grows to at least 89 mm SL, *Scorpaenodes insularis* Eschmeyer, 1971, grows to 78.8 mm SL (USNM 267880). *Scorpaenodes littoralis* Tanaka, 1917, reaches about 88 mm (Randall 1995; based on unspecified material 110 mm TL), *Scorpaenodes parvipinnis* (Garrett, 1864) attains at least 93 mm SL (SAIAB 112; but may reach about 112 mm SL according to Leiske and Myers 1994; based on unspecified materials 140 mm TL), *Scorpaenodes steeni* Allen, 1977, attains about 99.8 mm SL. *Scorpaenodes varipinnis* Smith, 1957, reaches about 104 mm SL (Kuiter and Tomozuka 2001; based on unspecified material 130 mm TL), and *Scorpaenodes xyris* (Jordan and Gilbert, 1882) attains about 120 mm SL (Eschmeyer, Herald, and Hammon 1983; based on unspecified material 150 mm TL). Most near-shore species are smaller.

Barcode sequence.— A 655-nucleotide sequence of the section of cytochrome c oxidase subunit I (COI) gene used for barcoding by the BOLD informatics database (Ratnasingham and Hebert, 2007) was obtained for one paratype (USNM 396088). This sequence was given the Genbank accession number GU357570. Although tissue from other *Scorpaenodes* species are listed in the BOLD database, COI gene sequences from these species have yet to be published. As recommended by the BOLD database management group, the 655 bp sequence (5′–3′) of the paratype is presented as follows:

CCTCTATCTAGTATTCGGTGCCTGAGCCGGCATGGTAGGCACAGCCCTGAGCCTACT-
TATTCGGGCAGAATTAAGCCAACCCGGCGCTCTCCTTGGAGATGACCAAATTTATAATG-
TAATTGTTACAGCACATGCTTTTGTGATAATTTTCTTTATAGTAATACCAATTAT-
GATTGGGGGATTTGGAAACTGGCTTATCCCACTAATGATTGGAGCACCAGACATGGCATTTC-
CTCGTATAAATAATATGAGCTTCTGACTTCTTCCACCCTCCTTCCTTCTCCTGCTTGCCTC-
CTCAGGAGTAGAGGCAGGTGCTGGGACGGGGTGAACAGTCTACCCCCCTCTGGCCGGCAAC-
CTGGCTCACGCCGGGGCATCCGTTGACTTAACAATTTTTTCCCTGCACTTAGCAGGGATCTCCTC-
CATCCTTGGCGCAATTAATTTTATTACTACAATTATTAACATAAAACCCCCAGCAATTTCTCAATAT-
CAAACGCCTTTGTTCGTCTGGGCTGTTTTAATTACCGCTGTTCTCCTTCTTCTTTCTCTACCAGTC-
CTTGCTGCCGGCATCACAATGCTCCTAACCGATCGTAACCTTAACACCACTTTCTTCGACCC-
CGCAGGAGGGGGGGACCCAATCCTTTACCAACACCTATTT.

Comparative material examined.— ***Hoplosebastes armatus*:** USNM 98898 (1, 86.3, holotype of *Hoplosebastes pristigenys* Fowler) 21°54′N, 114°46′E, vicinity of Hong Kong, 67.6 m. ZIN 22695 (1, 122.7, holotype of *Hoplosebastes armatus* Schmidt) Nagasaki. ***Scorpaenodes albaiensis*: EGYPT:** USNM 355353 (1, 48.1) Strait of Jubal, southern end of Sinai Peninsula at Ras Muhammad,. **FIJI:** CAS 206970 (1, 34.2) 19°9′38″S, 179°45′23″E, Lau Group, Matuku Id. CAS 206971 (5, 20.3–36.4) 18°58′57″S, 179°52′12″W, Totoya Id. CAS 206985 (1, 57.9) 172°6′S, 177°13′E, Naviti Id. CAS 214127 (1, 44.8) 18°09.52′S, 178°23.98′E, Barrier Reef off Suva. CAS 214150 (1, 51.7) 18°9.52′S, 178°23.98′E, Barrier reef off Suva. CAS 217433 (1, 35.6) 18°09.59′S, 178°23.96′E, Barrier Reef off Suva. CAS 218617 (1, 33.0)18°08.90′S, 178°23.91′E, Barrier Reef off Suva. CAS 219009 (1, 37.8) 18°09.59′S, 178°23.96′E, Barrier reef off Suva. CAS 219648 (2, 48.2–48.4) 18°10.84′S, 178°28.14′E, Barrier reef off Suva. **INDONESIA:** USNM 210019 (1, 32.3) Moluccas Ids., Ceram, just offshore and just W of Tandjung Namatatuni. USNM 392573 (1, 49.6) 5°17′20″S, 122°04′E, Suluwesi Id, Big Damalawa Islet, Kabaena Id, Tallabassi Bay. **MALAYSIA:** CAS 207053 (4, 13.5–46.0) Borneo, Sabah State, east end of Borneo, Pulav Bohidulong. **MOZAMBIQUE** SAIAB

397 (1, 40.3, paratype of *Hypomacrus africanus*) 14.2167°S, 40.7667°E, Mozambique, Pinda Id. SAIAB 398 (2, 65.2-67.8, paratypes of *Hypomacrus africanus*) 14.2167°S, 40.7667°E, Pinda I. SAIAB 400 (1, 62.2, paratype of *Hypomacrus africanus*) 11.1833°S, 40.6167°E, Querimba Archipelago. **PAPUA NEW GUINEA:** CAS 207058 (1, 54.4) New Britain, Dawapia Rocks. USNM 380226 (1, 26.5) 10°44′S, 165°49′30″E, Solomon Ids, Santa Cruz Id. USNM 380381 (2, 26.1–53.8 [scales damaged]) 1°30′30″S, 144°59′15″E, Hermit Ids. USNM 380946 (1, 42.5) 10°40′S, 165°47′30″E, Solomon Ids, Santa Cruz Id. USNM 382906 (1, 32.1) 10°49′30″S, 165°50′E, Solomon Is, Santa Cruz Is. USNM 383025 (4, 11.0–36.0) 10°42′30″S, 165°50′E. USNM 383806 (1, 19.6) 9°52′S, 167°09′30″E, Solomon Ids. USNM 384429 (2, 22.0–49.2) 10°48′30″S, 165°50′E. **PHILIPPINES:** CAS 211490 (2, 31.2–35.0) 13°42′N, 120°50′E, Caban Id. SU 20006 (1, 50.1, paratype of *Hypomacrus albaiensis* Evermann and Seale 1907) Sorsogon, Bacon. USNM 55902 (1, 48.9, holotype of *Hypomacrus albaiensis*, Luzon, Sorsogon, Bacon CAS 75357 (2,55.5-71.5), Luzon, Bulinao. USNM 344512 (8, 19.1–68.1) 10°35′05″N, 122°08′30″E, Panay Id. USNM 372602 (1, 48.7) 9°47′N, 118°44′E, Palawan Id, Puerto Princesa Bay. USNM 372637 (1, 52.8) 16°26′N, 119°50′E, Bolinao Lagoon. USNM 372638 (1, 45.8) 16°26′N, 119°56′E, Bolinao Lagoon. USNM 372662 (1, 53.2) 9°08′28″N, 123°29′40″E, Siquijor Id. USNM 372683 (1, 52.4) 10°52′30″N, 120°56′00″E, Bararin Id. USNM 372684 (1, 44.8) 9°02′27″N, 123°07′37″E, Negros Id, Bonbonon Pt. USNM 372685 (1, 42.1) 9°08′30″N, 123°29′22″E, Siquijor Id. **SEYCHELLES:** SAIAB 401 (2, 51.5–52.8, paratypes of *Hypomacrus africanus*) 4.6167°S, 55.4500°E, Mahe Id. SAIAB 402 (1, 46.2, paratype of *Hypomacrus africanus*) 9.4333°S, 46.3333°E, Aldabra Id. **TAIWAN:** ASIZ P0056237 (1, 45.5) [22.03°N, 120.72°E] Pingtung, Wanlitong. ASIZ P0056858 (2, 55.0–57.0) [22.67°N, 121.46°E] Nanlio, Lyudao. **TANZANIA:** SAIAB 323 (1, 62.4, holotype of *Hypomacrus africanus*) 6.1667°S, 39.1833°E, Zanzibar Id. SAIAB 399 (1, 72.0, paratype of *Hypomacrus africanus*) 6.1667°S, 39.1833°E, Zanzibar Id. SAIAB 403 (1, 53.2, paratype of *Hypomacrus africanus*) 5.1333°S, 39.6667°E, Pemba Id. **TONGA:** USNM 336568 (2, 29.3, 32.4) 21°19′30″S, 174°56′50″W, Eua. USNM 337718 (5, 16.8–30.8) 19°36′15″S, 174°28′15″W, Ha'apai Group, Ofolanga Id. **VANUATU:** USNM 348183 (1, 26.5) 17°41′39″S, 168°10′10″E, Efate. USNM 352337 (1, 26.0) 16°49′37″S, 168°22′15″E, Shepherd Ids, 11 Jun 1996. USNM 353504 (1, 42.5) 16°44′00″S, 168°07′35″E, Shepherd Ids, Epi Id. USNM 354461 (2, 39.7–41.7) 17°03′18″S, 168°21′43″E, Shepherd Ids, Emae Id. USNM 363285 (1, 26.2) 13°40′19″S, 167°39′04″E, Banks Ids, Mota Lava Id. USNM 363647 (1, 72.5) 13°40′19″S, 167°39′08″E, Banks Ids, Mota Lava Id. USNM 363767 (1, 47.3) 13°38′32″S, 167°30′18″E, Banks Ids, Rowa Id. USNM 364204 (1, 47.4) 16°43′36″S, 168°08′42″E, Shepherd Ids Epi Id. **UNKNOWN:** SAIAB 404 (2, paratypes of *Hypomacrus africanus*). ***Scorpaenodes investigatoris.*** **INDIA:** CAS 24264 (1, 71.1 holotype of *Scorpaenodes investigatoris*) 24°13′N, 65°52′E. USNM 204030 (1, 72.8, paratype of *Scorpaenodes investigatoris*) 17°25′N, 71°39′E. ***Scorpaenodes littoralis.*** **AUSTRALIA:** AMS I.17420005 (1, 59.4). AMS I.17422008 (1, 43.0). AMS I.27138019 (9, 19.5–65.6). AMS I.27148020 (15, 21.9–62.6). **HAWAIIAN IDS.:** CAS 33915 (1, 75.7) Oahu, Hauula Park. **ISRAEL:** HUJ 9349 (1, 35.3). **TAIWAN:** GCRL 23504 (1, 30.2). USNM 266431 (1, 55.3) Ma-Kong. **NEW ZEALAND:** NMNZ P.21812 (4, 51.4–80.9). ***Scorpaenodes minor*: CAROLINE IDS.:** USNM 224509 (1, 24.6) 6°52′N, 158°06′E, SW of Ponape. **COMORES IDS:** SAIAB 30868 (1, 30.8) 11.5833°S, 43.2667°E, Moroni. **FIJI:** CAS 206965 (1, 35.3) 18°54′0″S, 178°26′0″W, Lau Group, Yangasa Cluster. CAS 206969 (1, 23.3) 19°9′38″S, 179°45′23″E, Lau Group, Matuku Id. CAS 214151 (1, 18.3) 18°09.52′S, 178°23.98′E, Barrier Reef off Suva. CAS 214152 (1, 24.2) Barrier reef off Suva. CAS 214156 (1, 48.5) 18°9.52′S, 178°23.98′E, Barrier reef off Suva. CAS 218603 (2, 27.7–30.7) 18°09.835′S, 178°25.020′E, Barrier Reef off Suva. CAS 218609 (1, 28.6) 18°08.947′S, 178°23.932′E, Barrier reef off Suva. CAS 218620 (3, 17.3–17.2) 18°09.59′S, 178°23.96′E, Barrier Reef off Suva. CAS 219018 (7, 18.3–33.8) 18°09.59′S, 178°23.96′E, Barrier Reef off Suva. CAS 219027 (1, 25.4) 18°08.947′S, 178°23.932′E, Barrier Reef off Suva. CAS 219642 (2, 29.0–34.4) 18°09.52′S, 178°23.98′E, Barrier reef off Suva. **FRENCH POLYNESIA:** USNM 392263 (1, 19.6) 17°31′14″S, 149°45′44″W, Moorea. **INDONESIA:** USNM 99782 (1, 34.4, holotype of *Hypomacrus brocki*) Talisse Id. USNM 133077 (1, 29.5, paratype of *Hypomacrus brocki*) Patiente Strait. USNM 136438 (1, 26.7, paratype of *Hypomacrus brocki*) Gulf of Tonimi. **MARSHALL IS.:** USNM 140090 (1, 26.6, *paratype of Hypromacrus brocki*) Rongerik Atoll. USNM 140091 (1, 20.8, paratype of *Hypomacrus brocki*) Bikini Atoll, Arji Id. USNM 140228 (1, 27.2, paratype of *Hypomacrus brocki*) Rongelap Atoll, Kieshiechi Id. USNM 361009 (1, 20.4) Ratak Chain, Taka Atoll. **MOZAMBIQUE**: SAIAB 320 (1, 34.9, holotype of *Hypomacrus minor*) Bazaruto. SAIAB 405 (1, 32.6) Tekomaji.

SAIAB 406 (1, 39.1) Baixo Pinda. SAIAB 407 (1, 36.8) Baixo Pinda. SAIAB 408 (2, 35.1–38.9) Baixo Pinda. SAIAB 409 (7, 30.9–35.1) Bazaruto. **NEW CALEDONIA:** MNHN 1977-702 (2, 35.8-48.6). MNHN 1980-414 (1, 38.6) . MNHN 1980-572 (1, 29.9). USNM 324422 (1, 26.4) 20°37′19″S, 166°16′12″E, Loyalty Ids, Ouvea Atoll, Bagaat. **PAPUA NEW GUINEA:** CAS 207746 (8, 11.1–34.7) Trobriand Ids., Kiriwina Id. USNM 380373 (1, 24.2) 1°33′S, 144°59′E, Hermit Ids, Amot Id. USNM 384521 (1, 31.2) 10°44′12″S, 166°49′30″E, Solomon Ids, Ndendo. USNM 389540 (1, 21.2) 10°16′30″S, 166°16′30″E, Solomon Ids, Fenualoa Id. **PHILIPPINES:** USNM 99783 (1, 39.0, paratype of *Hypomacrus brocki*) Romblon. USNM 133076 (1, 34.1, paratype of *Hypomacrus brocki*) Manila Bay, Limbones Cove. USNM 298679 (1, 51.4) Batan Id. USNM 372689 (1 of 2, 30.4) 9°02′45″N, 123°07′37″E, Negros Id, off Bonbonon Point. **RODRIGUES ID.:** SAIAB 70479 (1, 31.8) 19°41′38″S, 63°17′36″E, off Ile aux Sables. **SEYCHELLES:** SAIAB 410 (2, 35.1–40.3, paratypes of *Hypomacrus minor*) Mahe. SAIAB 412 (2, 24.4- 31.2, paratypes of *Hypomacrus minor*) Aldabra. **TONGA:** USNM 334501 (1, 23.4) 21°18′15″S, 174°26′20″W, Eua. **WALLIS AND FUTUNA IS.:** USNM 365621 (3, 26.8–33.1) 13°21′30″S, 176°10′10 W, Uvea. USNM 373669 (1, 35.7) 13°16′50″S, 176°15′55″W, Uvea. USNM 373670 (7, 15.5–41.7[photo]) 13°16′50″S, 176°15′55″W, Uvea. USNM 373672 (1, 20.0) 13°16′50″S, 176°15′55″W, Uvea. USNM 376660 (9, 9.8 -24.5) 13°12′35″S, 176°14′45″W, Uvea. ***Scorpaenodes smithi.*** **ALDABRA ATOLL:** USNM 298642 (2, 24.3–28.4) Picard Id. **AUSTRALIA:** BMNH 1933.8.11.4 (1, 35.8, paratype of *Scorpaenodes smithi*) 11°30′00″S, 126°38′00″E, Samul [Sakul?] Bank. **INDIA:** BMNH 1932.2.15.15-20 (4 of 6, 25.1–48.3, paratypes of *Scorpaenodes smithi*) 6°1′20″N, 99°3′5″E, off Madras. CAS 13616 (1 of 4, 23.2–52.1, paratypes of *Scorpaenodes smithi*) 5°45′N, 98°20′E. ***Scorpaenodes tribulosus.*** **KENYA:** CAS 24267 (1, 51.2, holotype of *Scorpaenodes tribulosus*) 2°42′S, 40°53′E. CAS 75361 (2, 37.3–44.3) 02°42′S, 40°53′E. ***Thysanichichtys crossotus*****: JAPAN:** USNM 50907 (1, 68.7, holotype of *Thysanichichtys crossotus*) no other data. **TAIWAN:** CAS 47297 (1, 91.7) Ta-chi, I-lan. CAS 53360 (1, 88.5). ***Thysanichthys evides*****:** SU 22611 (6, 27.9–68.4, 5 of which are paratypes of *Thysanichthys evides*) Misaki.

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References

ALCOCK, A.W. 1889. Natural history notes from H.M. Indian Marine Surveying Steamer '*Investigator*,' Commander Alfred Carpenter, R.N., D.S.O., commanding. No. 12. Descriptions of some new and rare species of fishes from the Bay of Bengal, obtained during the season of 1888–89. *Journal of the Asiatic Society of Bengal*, ser. part 2, 58(17):296–305, 22 pls.

ALCOCK, A.W. 1898. *Illustrations of the zoology of the Royal Indian Marine Surveying Steamer* 'Investigator', *under the command of Commander A. Carpenter, R. N., D. S. O., and of Commander R. F. Hoskyn, R. N.,* Part 5, *Fishes,* pls. 18–24. Royal Indian Marine, Calcutta, India.

BLEEKER, P. 1857. Bijdrage tot de kennis der ichthyologische fauna van de Sangi-eilanden. *Natuurkundig Tijdschrift voor Nederlandsch Indië* 13:369–380. [In Dutch]

ESCHMEYER, W.N. 1965. Western Atlantic scorpionfishes of the genus *Scorpaena*, including four new species. *Bulletin of Marine Sciences* 15(1):84-164.

ESCHMEYER, W.N. 1969a. A new scorpionfish of the genus *Scorpaenodes* and *S. muciparus* (Alcock) from the Indian Ocean, with comments on the limits of the genus. *Occasional Papers of the California Academy of Sciences*, no. 76. 11 pp., 1 fig., 1 table.

ESCHMEYER, W.N. 1969b. A systematic review of the scorpionfishes of the Atlantic Ocean (Pisces: Scorpaenidae). *Occasional Papers California Academy of Sciences*, no. 79. 143 pp., 13 figs.

ESCHMEYER, W.N. 1986. Family No. 49: Scorpaenidae, Pages 463–478 *in* M.M. Smith and P.C. Heemstra, eds., *Smith's Sea Fishes.* MacMillan South Africa Ltd, Johannesburg, South Africa. 481 pp.

ESCHMEYER, W.N., AND R.M. BAILEY. 1990. *Catalog of the Genera of Recent Fishes*. California Academy of Sciences, San Francisco, California, USA. 697 pp.

ESCHMEYER, W.N., AND L.J. DEMPSTER. 1990. Pages 665–679 *in* J. C. Quéro, J. C. Hureau, C. Karrer, A. Post, and L. Saldanha, *Check-list of the Fishes of the Eastern Tropical Atlantic*. Clofeta. Vol. II. Junta Nacional de Investigação Cientifica e Tecnológica, Portugal.

ESCHMEYER, W.N., E.S. HERALD, AND H. HAMMANN. 1983. *A Field Guide to Pacific Coast Fishes of North America*. Houghton Mifflin Company, Boston, Massachusetts, USA. 336 pp.

ESCHMEYER, W.N. AND K.V. RAMA-RAO. 1972. Two new scorpionfishes (genus *Scorpaenodes*) from the Indowest Pacific with comments on *Scorpaenodes muciparous* (Alcock). *Proceedings of the California Academy of Sciences*, ser. 4, 39(18):337–382.

EVERMANN, B.W., AND A. SEALE. 1907. Fishes of the Philippine Islands. *Bulletin of the United States Bureau of Fisheries* 26(1906):49–110, 22 figs.

GARMAN, S. 1899. Reports on an exploration off the west coasts of Mexico, Central and South America, and off the Galápagos Islands, in charge of Alexander Agassiz, by the U. S. Fish Commission Steamer "*Albatross*," during 1891, Lieut. Commander Z. L. Tanner, U. S. N., Commanding. XXVI. The Fishes. *Memoirs of the Museum of Comparative Zoology* 24:1–431, 97 pls. (plates A–N in color).

GILL, T.N. 1862. Notice of a collection of the fishes of California, presented to the Smithsonian Institution by Mr. Samuel Hubbard. *Proceedings of the Academy of Natural Sciences of Philadelphia* 14:274–282.

GROVE, J.S., AND R.J. LAVENBERG. 1997. *The Fishes of the Galápagos Islands*. Stanford University Press, Palo Alto, California, USA. xliv + 863 pp.

GÜNTHER, A. 1880. Report on the shore fishes procured during the voyage of H. M. S. *Challenger* during the years 1873–1876. *Zoology of the Challenger Expedition*, 1(6):1–82, pls. 1–32.

HELLER, E., AND R.E. SNODGRASS. 1903. Papers from the Hopkins Stanford Galápagos Expedition, 1898–1899. XV. New Fishes. *Proceedings of the Washhington Academy of. Sciences* 5:189–229, pls. 2–20.

HERRE, A.W.C.T. 1952. A review of the scorpaenoid fishes of the Philippines and adjacent seas. *Philippine Journal of Science* 80(4):381–482. (dated 1951, but published in 1952)

HERRE, A.W.C.T. 1953. Check list of Philippine Fishes. *United States. Fish and Wildlife Service Research Reports*, No. 20. 977 pp.

HOCHBERG, Y., AND A.C. TAMHANE. 1987. *Multiple Comparison Procedures*. Wiley, Hoboken, New Jersey, USA. 450 pp.

IMAMURA, H. 2004. Phylogenetic relationships and a classification of the superfamily Scorpaenoidea (Actinopterygii: Perciformes). *Species Diversity* 9:1-36.

ISHIDA, M. 1994. Phylogeny of the suborder Scorpaenoidei. *Bulletin of the Nansei National Fisheries Research Institute* (27):1–111.

JENYNS, L. 1840. Fish. In: *The Zoology of the Voyage of H.M.S. Beagle, under the command of Captain FitzRoy, R.N. during the years 1832-1836. Edited and superintended by Charles Darwin*. Smith, Elder and Co., London, UK. In 4 parts, i–xvi + 172 pp., pls. 1-29.

JORDAN, D.S. 1923. A classification of fishes including families and genera as far as known. *Stanford University Publications, Biological Sciences, University Series* 3(2):77–243 + i–x.

JORDAN, D.S., AND B.W. EVERMANN. 1898. The Fishes of North and Middle America, Pt. 2. *Bulletin of the United States National Museum* 47(2):i–xxx + 1241–2183, 2 figs.

JORDAN, D.S., AND E.C. STARKS. 1904. A review of the scorpaenoids fishes of Japan. *Proceedings of the United States National Museum* 27:91–175.

JORDAN, D.S., AND W.F. THOMPSON. 1914. Record of the fishes obtain in Japan in 1911. *Memoirs of the Carnegie Museum*. 45(4):205–313, pls. xxiv–xlii.

KUITER, R.H., AND T. TONOZUKA. 2001 *Pictorial Guide to Indonesian Reef Fishes*. Part 1. *Eels-Snappers, Muraenidae–Lutjanidae*. Zoonetics, Australia. 302 pp.

LIESKE, E., AND R.F. MYERS. 1994. *Collins Pocket Guide. Coral Reef Fishes. Indo-Pacific and Caribbean including the Red Sea*. Harper Collins, London, UK. 400 pp.

MANDRYTSA, S.A. 1991. Морфлогичекие осбенности и положение в системе *Thysanichthys crossotus* (Scorpaeniformes, Scorpaenidae) [Morphological Characterization and Systematic Status of *Thysanichthys crossotus* (Scorpaeniformes, Scorpaenidae)]. *Proceedings Zoological Institute, Academy of Sciences, Union of Soviet Socialist Republics* 235:9–21. (In Russian)

MANDRYTSA, S.A. 2001. *Сейсмосенсорная Система И Классификация Скорпеновидный Рыь (Scorpaeniformes: Scorpaenoidei)* [*Lateral Line System and Classification of Scorpaenoid Fishes (Scorpaeniformes: Scorpaenoidei)*]. Perm Permskogo University Press, Perm, Russia. 392 pp. (In Russian)

MATSUBARA, K. 1943. *Studies on the Scorpaenoid Fishes of Japan. Anatomy, Phylogeny and Taxonomy* (I). Transactions of the Sigenkagaku Kenkyusho, Tokyo, Japan. 170 pp., 66 figs.

MCCOSKER, J.E. 1987. *The fishes of the Galápagos Islands*. *Oceanus* 30:28–32.

MCCOSKER, J.E. 1997. A letter from the field: A half mile down. *Pacific Discovery* 50:42–45.

MCCOSKER, J.E. 1998. [Review of] Fishes of the Galápagos Islands, by J. S. Grove and R. J. Lavenberg, 1997. *Copeia*, 1998(3):809–812.

MCCOSKER, J.E. 2008. *Trachyscorpia osheri* and *Idiastion hageyi*, Two new species of deepwater scorpionfishes (Scorpaeniformes: Sebastidae, Scorpaenidae) from the Galápagos Islands. *Proceedings of the California Academy of Sciences*, ser. 4, 59(3):113–123, 5 figs., 1 table.

MEEK, S.E., AND R. NEWLAND. 1885. A review of the American species of the genus *Scorpaena*. *Proceedings of the Academy of Natural Sciences of Philadelphia* 37:394–403.

MOTOMURA, H., AND J.E. MCCOSKER. 2009. Second specimen of the Costa Rican scorpionfish, *Scorpaena cocosensis* (Scorpaenidae): the first record from the Galápagos Islands, with fresh color notes on the Species. *Biogeography* 11:135–137.

MOTOMURA, H., Y. SAKURAI, AND G. SHINOHARA. 2009. First records of a Scorpionfish, *Scorpaenodes albaiensis*, from East Asia, with a synopsis of *S. minor* (Actinopterygii: Scorpaeniformes: Scorpaenidae). *Species Diversity* 14(2):75–87

NAKABO, T. 2002. *Fishes of Japan with Pictorial Keys to the Species*, English Edition, Vol. 1. Tokai University Press, Tokai, Japan. lxi + 866 pp.

PRESS, W.H., B.P. FLAMMER, S.A. TEUKOLSKY, AND W.T. VETTERLING. 1988. *Numerical Recipes*. Cambridge University Press, New York, New York, USA. 1256 pp.

POSS, S.G., AND B.B. COLLETTE. 1990. *Scorpaenodes immaculatus*, a new species of scorpionfish (Osteichthyes: Scorpaenidae) from Walters Shoals, Madagascar Ridge. *Proceedings of the Biological Society of Washington* 103(3):543–549, figs. 1–3

POSS, S.G., AND W.N. ESCHMEYER. 1978. Two new Australian velvetfishes, genus *Paraploactis* (Scorpaeniformes: Aploactinidae), with a revision of the genus and comments on the genera and species of the Aploactinidae. *Proceedings of the California Academy of Sciences*, ser. 4, 41(18):401–426, 14 figs.

RANDALL, J.E. 1995. *Coastal Fishes of Oman*. University of Hawai'i Press, Honolulu, Hawaii, USA. xiv + 439 pp.

RANDALL, J.E., AND S.G. POSS. 2002. Redescription of the Indo-Pacific Scorpionfish *Scorpaenopsis fowleri* and Reallocation to the Genus *Sebastapistes*. *Pacific Science* 56(1):57–64.

ROBERTSON, D.R., J.S. GROVE, AND J.E. MCCOSKER. 2004. Tropical transpacific shore fishes. *Pacific Science* 58(4):507–565.

ROHLF, F.J., AND F.L. BOOKSTEIN. 1988. A comment on shearing as a method for "size correction". *Systematic Zoology* 36:356–367.

SAUVAGE, H.E. 1873. Note sur le *Sebastes minutus*. *Annales Sciences Naturel.* (*Zoologie*), Paris, ser. 5, 17(5):1.

SCHMIDT, P. 1929. On *Hoplosebastes armatus*, a new genus and new species of the family Scorpaenidae from Japan. *Comptes Rendu Academie Sciences, l'URSS.*, Leningrad, USSR 8:194–196 pp., figs. 1–2.

SCHULTZ, L.P. 1966. Fishes of the Marshall and Marianas Islands, vol. 3. *Bulletin of the United States National Museum* no. 202. vii + 176 pp., pls. 124–148, 155 figs.

SEALE, A. 1940. Report on fishes from Allan Hancock Expedition in the California Academy of Sciences. *Allan Hancock Pacific Expeditions* 9(1):1–46.

SHINOHARA, G., AND H. IMAMURA. 2007. Revisiting recent phylogenetic studies of "Scorpaeniformes". *Ichthyological Research* 54:92–99.

SMITH, J.L.B. 1957. The fishes of the family Scorpaenidae in the western Indian Ocean. Part 1. The subfamily Scorpaeninae. *Ichthyological Bulletin*, J.L.B. Smith Institute of Ichthyology, Rhodes University, (4):49–72, pls. 1–4.

SMITH, J.L.B. 1958. Fishes of the families Tetrarogidae, Caracanthidae, and Synanciidae from the western Indian Ocean with further notes on Scorpaenid fishes. *Ichthyological Bulletin*, J.L.B. Smith Institute of Ichthyology, Rhodes University, (12):167–181 pp., 2 pls.

SMITH, W.L., AND W.C. WHEELER. 2004. Polyphyly of the mail-cheeked fishes (Teleostei: Scorpaeniformes): evidence from mitochondrial and nuclear sequence data. *Molecular Phylogeny and Evolution* 32:627-646.

SNODGRASS, R.E., AND E. HELLER. 1905. Papers from the Hopkins-Stanford Galápagos Expecition, 1898–1899. XVII. Shore fishes of the Revillagigedo, Clipperton, Cocos and Galápagos islands. *Proceedings of the Washington Academy of Sciences* 6:333–427.

TANAKA, S. 1917. Eleven new species of fishes of Japan. *Dobutsugaku Zasshi* [*Zoological Magazine*], Tokyo, 29:7–12. [In Japanese]

WEBER, M., AND L.F. DE BEAUFORT. 1962. *The fishes of the Indo-Australian Archipelago*, XI. *Scleroparei, Hypostomides, Pediculati, Plectognathi, Opisthomi, Discocephali, Xenopterygii*. E.J. Brill, Leiden, Netherlands. 481 pp.

WELLINGTON, G.M. 1978. Undersea wonders of the Galápagos. *National Geographic Magazine* 154(3): 363–381.

Appendix

Tables 1–10

TABLE 1. Summary of statistics of counts for species of *Scorpaenodes* and *Thysanichthys* compared in this study (1 – in 1 of the 3 known specimens of *S. tribulosus* the scales on the caudal peduncle are lost and the count is probably low).

		Total Dorsal Rays		Pectoral Fin-rays (Left+Right/2)		Total Gill Rakers (Left+Right/2)		Vertical Scale Rows		Mean Lateral-line Scales (Left+Right/2)	
	N	Mean (Minimum - Average)	SE	Mean (Minimum - Average)	SE	Mean (Minimum - Average)	SE	Mean (Minimum - Average)	SE	Mean(Minimum)	SE
Scorpaenodes rubrivinctus	7	22.4(21.5-23.5)	0.308	19.1(18.0-20.0)	0.24	16.0(15.0-17.0)	0.289	47.7(43.0-51.0)	0.944	25.0(23.0-26.5)	0.408
Scorpaenodes albaiensis	30	22.4(17.5-23.5)	0.198	15.8(14.5-17.0)	0.919	14.9(12.0-19.5)	0.302	39.0(34.0-43.0)	0.473	22.5(18.5-24.5)	0.243
Scorpaenodes minor	25	21.7(20.0-22.5)	0.107	15.0(14.0-16.0)	0.098	13.1(9.5-15.5)	0.241	31.4(25.0-37.0)	0.64	19.9(15.0-23.5)	0.543
Scorpaenodes investigatoris	2	22.5(22.5-22.5)	--	19.0(19.0-19.0)	--	18.2(18.0-18.5)	0.25	39.5(39.0-40.0)	0.5	20.0(16.0-24.0)	4
Scorpaenodes smithi	8	22.0(21.5-22.5)	0.189	17.2(17.0-18.0)	0.134	17.2(16.5-18.5)	0.231	38.4(35.0-44.0)	1.224	21.8(14.5-24.5)	1.08
*Scorpaenodes tribulosus*1	3	21.5(21.5-21.5)	--	18.3(18.0-18.5)	0.167	14.7(13.0-15.0)	0.882	36.0(31.0-39.0)	2.517	20.2(14.0-21.0)	3.346
Thysanichthys crossotus	3	24.5(24.5-24.5)	--	16.6(16.5-17.0)	0.167	16.7(16.0-17.5)	0.441	45.7(43.0-48.0)	1.45	25.0(24.5-26.0)	0.5
Thysanichthys evides	6	22.2(21.5-22.5)	0.211	18.0(17.5-18.5)	0.129	16.6(15.5-17.5)	0.665	42.7(38.0-46.0)	1.145	24.0(23.0-25.0)	0.341
Scorpaenodes littoralis	36	21.2(21.5-22.5)	0.076	18.2(17.0-19.0)	0.085	17.(14.5-20.0)	0.189	39.9(33.0-46.0)	0.59	24.0(20.5-25.5)	0.184

TABLE 2. Summary of regression statistics for body measures of *Scorpaenodes rubrivinctus* based on pooled parallel slopes model of regression. Mean %SL based on *S. rubrivinctus* alone. P-values indicate significance levels for contrasts among Y-intercepts that are significantly different between *S. rubrivinctus* and other species of *Scorpaenodes* and *Thysanichthys* (n = 7).

Measured Variable	Mean %SL(Min-Max)	(α + αi)	β	S.E.	Probability
Head Length:	46.4(44.8-47.3)	2.03+2.39	0.415	0.301	P < 0.001**
Snout Length:	14(12.7-14.9)	0.111+2.00	0.117	0.187	P < 0.001**
Orbit Diameter:	12.9(11.7-13.9)	1.89+0.693	0.1	0.203	P < 0.001**
Interorbital Width:	4.74(3.97-6.27)	0.593-0.489	0.047	0.144	P < 0.001**
Jaw Length:	20.6(20.1-21.5)	0.217-0.654	0.211	0.197	P < 0.05*
Postorbital Length:	20.8(19.8-21.4)	0.289-0.246	0.208	0.242	P < 0.05*
Greatest Body Depth:	34(33-35.4)	1.18-1.42	0.342	0.431	P < 0.05*
Predorsal Length:	43.5(40.6-46.2)	1.79+1.59	0.397	0.353	P < 0.001**
Anal Fin Length:	26.9(23.6-29.7)	2.13-1.05	0.256	0.352	P < 0.05*
Caudal Fin Length:	24.3(22.7-26.4)	1.13-1.56	0.247	0.582	P < 0.05*
Pectoral Fin Length:	31.1(24.4-36.7)	3+0.114	0.275	1.1	
Pelvic Fin Length:	21(9.61-27.5)	0.747-3.35	0.239	0.864	
First Dorsal Spine Length (D1):	7.75(5.86-9.35)	0.822+0.817	0.059	0.283	P < 0.05*
Second Dorsal Spine Length (D2):	12.6(9.38-14.5)	1.51+1.58	0.092	0.368	P < 0.001**
Third Dorsal Spine Length (D3):	18.1(16.2-19.7)	2.08+3.71	0.116	0.33	P < 0.001**
Fourth Dorsal Spine Length (D4):	18.6(16.6-20.3)	2.02+3.47	0.124	0.31	P < 0.001**
Fifth Dorsal Spine Length (D5):	15.8(10.6-17.9)	1.71+1.37	0.122	0.41	P < 0.05*
Penultimate Dorsal Spine Length (PDS):	6.44(5.16-7.75)	-0.2209	0.067	0.26	
Last Dorsal Spine Length (LDS):	12.4(11.1-14.4)	0.255+1.53	0.104	0.296	P < 0.001**
First Anal Spine Length:	10.8(9.43-14)	1.804	0.089	0.279	P < 0.001**
Second Anal Spine Length:	20.6(19.2-22.5)	0.339	0.202	0.333	P<0.05*
Third Anal Spine Length:	16(14.6-17.8)	-0.427	0.163	0.241	
Caudal Peduncle Depth:	9.24(8.42-9.73)	0.29-0.74	0.097	0.127	P < 0.001**
Snout Tip to Base of D2:	45.1(43.2-48.9)	1.92+2.01	0.408	0.358	P < 0.001**
Snout Tip to Base of D3:	48.6(45.8-51.5)	2.11+2.59	0.434	0.455	P < 0.001**
Snout Tip to Base of D4:	52.4(49.4-54.6)	2.00+2.64	0.471	0.436	P < 0.001**
Snout Tip to Base of D5:	55.4(53.7-59)	2.06+1.98	0.51	0.409	P < 0.001**
Tip of D4 to Fin Membrane:	10.7(9.71-12.4)	1.44+2.88	0.0591	0.235	P < 0.001**
Snout Tip to Pelvic Fin Insertion:	43.2(39.8-46.6)	1.84+1.22	0.399	0.575	P < 0.05*
D1 Base to D5 Base:	13.3(12.4-15.5)	0.533+0.134	0.125	0.276	
D5 Base to Pelvic Fin Insertion:	36.6(34.8-38.9)	1.21-1.30	0.365	0.457	P < 0.05*
D1 Base to Pelvic Fin Insertion:	33.6(32.3-34.6)	0.855-3.13	0.361	0.791	P < 0.001**
D5 Base to LDS:	25.6(24-27.3)	-2.88	0.287	0.601	
LDS Base to Last D. Ray Base (LDR):	16.1(12.5-18)	-2.062	0.183	0.452	P < 0.05*
LDR Base to Last Anal Ray (LAR):	13.1(12.1-14.2)	-2.743	0.161	0.357	P < 0.001**
Anal Fin Origin to LAR:	14.3(13.2-15.2)	0.58-0.0453	0.136	0.489	
Pelvic Fin Insertion to Anal Fin Origin:	33.1(29.9-36.4)	-4.41	0.377	0.59	P < 0.05*
D1 Base to Anal Fin Origin:	47.2(46.2-49.2)	-3.278	0.507	0.478	P < 0.001**
LDS Base to Pelvic Fin Insertion:	45.3(42.7-48.2)	-2.344	0.477	0.551	
LDS Base to Base of LAR:	22.8(21.7-24.1)	-2.411	0.253	0.326	P < 0.001**
LDR Base to Anal Fin Origin:	24.8(23.4-27.2)	0.304-0.422	0.25	0.346	
LDS Base to Anal Fin Origin:	27.2(25.5-31.5)	0.200-0.916	0.28	0.48	P<0.001**
D5 Base to Anal Fin Origin:	39.9(37.9-42.4)	-3.439	0.437	0.389	P < 0.001**

TABLE 3. Summary of regression statistics for body measures of *Scorpaenodes albaiensis* based on a pooled parallel slopes model of regression. Mean %SL based on *S. albaiensis* alone. P-values indicate significance levels for contrasts among Y-intercepts that are significantly different between this species and *S. rubrivinctus* (n = 35).

Measured Variable	Mean %SL(Min-Max)	(α + αi)	β	S.E.	Probability
Head Length:	43.6(40.5-50.5)	2.03-1.11	0.415	0.146	P < 0.001**
Snout Length:	12.3(10.2-16.0)	0.111+0.00	0.117	0.0907	P < 0.05*
Orbit Diameter:	12.0(9.78-16.4)	1.89-1.05	0.1	0.0983	P < 0.001**
Interorbital Width:	4.71(4.01-7.33)	0.593-0.596	0.046	0.0699	
Jaw Length:	21.1(19.3-24.1)	0.217-0.253	0.211	0.0952	
Postorbital Length:	21.0(18.7-22.9)	0.289-0.156	0.208	0.117	
Greatest Body Depth:	30.5(26.8-37.0)	1.18-3.1	0.342	0.208	
Predorsal Length:	43.1(40.1-48.7)	1.79-0.211	0.397	0.171	P < 0.001**
Anal Fin Length:	27.1(22.7-31.2)	2.13-1.49	0.256	0.171	
Caudal Fin Length:	25.0(15.7-29.4)	1.13-1.09	0.247	0.282	
Pectoral Fin Length:	31.9(20.1-41.1)	3-0.941	0.276	0.534	
Pelvic Fin Length:	24.9(23.1-28.3)	0.747-0.256	0.239	0.418	
First Dorsal Spine Length (D1):	5.94(3.17-9.26)	0.822-0.874	0.0593	0.137	P < 0.001**
Second Dorsal Spine Length (D2):	9.29(6.03-12.0)	1.51-1.52	0.0916	0.178	P < 0.001**
Third Dorsal Spine Length (D3):	11.8(8.15-15.4)	2.08-2.1	0.116	0.16	P < 0.001**
Fourth Dorsal Spine Length (D4):	12.8(10.0-16.5)	2.02-1.95	0.125	0.15	P < 0.001**
Fifth Dorsal Spine Length (D5):	12.9(9.87-16.7)	1.71-1.48	0.123	0.199	P < 0.001**
Penultimate Dorsal Spine Length (PDS):	5.05(3.79-8.44)	-0.794	0.0666	0.126	
Last Dorsal Spine Length (LDS):	9.54(7.27-11.8)	0.255-0.71	0.105	0.143	P < 0.001**
First Anal Spine Length:	8.29(5.89-11.2)	-0.586	0.0887	0.135	P < 0.05*
Second Anal Spine Length:	20.7(17.9-23.1)	-0.197	0.202	0.161	
Third Anal Spine Length:	16.6(14.8-19.2)	-0.222	0.164	0.117	
Caudal Peduncle Depth:	9.82(8.56-11.6)	0.29-0.256	0.0972	0.0614	
Snout Tip to Base of D2:	44.1(40.5-49.6)	1.92-0.325	0.407	0.174	P < 0.05*
Snout Tip to Base of D3:	46.8(41.5-52.4)	2.11-0.601	0.435	0.22	P < 0.05*
Snout Tip to Base of D4:	49.9(44.4-54.6)	2-0.829	0.473	0.211	P < 0.001**
Snout Tip to Base of D5:	53.4(48.8-58.4)	2.06-0.967	0.509	0.198	P < 0.001**
Tip of D4 to Fin Membrane:	5.84(4.07-8.1)	1.44-1.56	0.0593	0.114	P < 0.001**
Snout Tip to Pelvic Fin Insertion:	41.5(36.3-49.2)	1.84-0.976	0.398	0.279	P < 0.001**
D1 Base to D5 Base:	11.9(10.0-17.9)	0.533-0.866	0.125	0.133	
D5 Base to Pelvic Fin Insertion:	33.6(29.1-38.3)	1.21-2.77	0.366	0.221	
D1 Base to Pelvic Fin Insertion:	32.3(27.8-49.1)	0.855-2.82	0.361	0.383	
D5 Base to LDS:	26.4(21.2-30.8)	-1.32	0.288	0.291	
LDS Base to Last Dorsal Ray Base (LDR):	15.5(9.98-19.1)	-1.315	0.183	0.219	
LDR Base to Last Anal Ray (LAR):	14.3(10.5-17.1)	-0.953	0.161	0.173	P < 0.05*
Anal Fin Origin to LAR:	12.1(9.72-14.5)	0.58-1.38	0.137	0.237	
Pelvic Fin Insertion to Anal Fin Origin:	35.2(29.2-41.5)	-2.79	0.378	0.285	P < 0.001**
D1 Base to Anal Fin Origin:	46.2(41.4-49.9)	-2.288	0.508	0.231	
LDS Base to Pelvic Fin Insertion:	44.3(33.1-49.4)	-1.774	0.479	0.267	
LDS Base to Base of LAR:	22.5(20.2-24.9)	-1.431	0.254	0.158	
LDR Base to Anal Fin Origin:	23.0(20.5-25.9)	0.304-1.31	0.25	0.168	
LDS Base to Anal Fin Origin:	24.4(20.8-27.6)	0.2-1.99	0.279	0.232	
D5 Base to Anal Fin Origin:	39.5(34.3-42.1)	-2.089	0.437	0.188	

TABLE 4. Summary of regression statistics for body measures of *Scorpaenodes minor* based on a pooled parallel slopes model of regression. Mean %SL based on *S. minor* alone. P-values indicate significance levels for contrasts among Y-intercepts that are significantly different between this species and *S. rubrivinctus* (n=25).

Measured Variable	Mean %SL(Min-Max)	(α + αi)	β	S.E.	Probability
Head Length:	44.2(41.5-48.4)	2.03-1.15	0.415	0.195	P < 0.001**
Snout Length:	12.2(10.5-14.7)	0.111+0.00	0.117	0.121	
Orbit Diameter:	12.2(10.1-14)	1.89-1.18	0.1	0.132	P < 0.001**
Interorbital Width:	4.92(3.95-6.58)	0.593-0.501	0.047	0.094	P < 0.001**
Jaw Length:	21.4(20.2-23.4)	0.217-0.116	0.21	0.127	
Postorbital Length:	21.8(19.2-24.4)	0.289+0.00	0.208	0.157	
Greatest Body Depth:	30.2(24.5-33.9)	1.18-2.53	0.342	0.279	
Predorsal Length:	43.8(40.2-48.3)	1.79-0.418	0.397	0.229	P < 0.001**
Anal Fin Length:	27.5(25-31.4)	2.13-1.5	0.256	0.228	
Caudal Fin Length:	25.9(21.4-28.2)	1.13-0.718	0.247	0.378	
Pectoral Fin Length:	31.7(21.1-40.9)	3.0-1.66	0.275	0.715	
Pelvic Fin Length:	24.9(21.5-29)	0.747-0.405	0.234	0.561	
First Dorsal Spine Length (D1):	5.87(4.56-7.69)	0.822-0.847	0.059	0.183	P < 0.001**
Second Dorsal Spine Length (D2):	9.09(6.69-11.1)	1.51-1.51	0.092	0.239	P < 0.001**
Third Dorsal Spine Length (D3):	11.6(8.98-13.4)	2.08-2.07	0.116	0.214	P < 0.001**
Fourth Dorsal Spine Length (D4):	12(9.63-14.6)	2.02-2.15	0.124	0.201	P < 0.001**
Fifth Dorsal Spine Length (D5):	11.7(8.99-14.3)	1.71-1.9	0.122	0.266	P < 0.001**
Penultimate Dorsal Spine Length (PDS):	4.14(2.72-6.45)	-0.856	0.067	0.169	
Last Dorsal Spine Length (LDS):	8.23(5.13-10.5)	0.255-1.02	0.104	0.192	P < 0.001**
First Anal Spine Length:	7.46(5.19-9.07)	-0.586	0.088	0.181	P < 0.05*
Second Anal Spine Length:	20.3(15.9-24.6)	-0.197	0.202	0.216	
Third Anal Spine Length:	15.6(12.3-17.7)	-0.2712	0.163	0.156	
Caudal Peduncle Depth:	10(8.42-11.4)	0.29-0.191	0.097	0.082	
Snout Tip to Base of D2:	44.6(42.2-47.7)	1.92-0.62	0.408	0.232	P < 0.05*
Snout Tip to Base of D3:	47.3(43.1-50.6)	2.11-0.822	0.434	0.295	P < 0.05*
Snout Tip to Base of D4:	50.6(47.2-57)	2-0.895	0.471	0.283	P < 0.05*
Snout Tip to Base of D5:	54.4(50.7-60.4)	2.06-0.912	0.51	0.265	P < 0.001**
Tip of D4 to Fin-Membrane:	5.94(3.89-8.96)	1.44-1.44	0.059	0.152	P < 0.001**
Snout Tip to Pelvic Fin Insertion:	40.4(38-44.2)	1.84-1.64	0.399	0.373	
D1 Base to D5 Base:	12.1(9.36-16.5)	0.533-0.691	0.125	0.179	
D5 Base to Pelvic Fin Insertion:	33.5(24.3-37.3)	1.21-2.27	0.365	0.296	
D1 Base to Pelvic Fin Insertion:	31.7(28.1-46.2)	0.855-2.26	0.361	0.513	
D5 Base to LDS:	26.3(19.4-43.3)	-1.32	0.287	0.39	
LDS Base to Last Dorsal Ray Base (LDR):	15.3(12.7-27)	-0.986	0.183	0.293	
LDR Base to Last Anal Ray (LAR):	14(10.3-24.5)	-0.953	0.161	0.231	P < 0.05*
Anal Fin Origin to LAR:	13.3(10.7-34.3)	0.58-0.614	0.136	0.317	
Pelvic Fin Insertion to Anal Fin Origin:	35.7(26-46.7)	-2.79	0.377	0.382	P < 0.001**
D1 Base to Anal Fin Origin:	45.7(42.3-48.5)	-1.708	0.507	0.31	
LDS Base to Pelvic Fin Insertion:	44.2(40.8-48.6)	-1.215	0.477	0.358	
LDS Base to Base of LAR:	21.6(18.2-24.5)	-1.284	0.253	0.211	
LDR Base to Anal Fin Origin:	22.7(19.5-25.2)	0.304-1.08	0.25	0.225	
LDS Base to Anal Fin Origin:	24.3(19.5-37.7)	0.2-1.36	0.28	0.311	
D5 Base to Anal Fin Origin:	38.2(30.7-45.7)	-1.819	0.436	0.252	

TABLE 5. Summary of regression statistics for body measures of *T. crossotus* based on a pooled parallel slopes model of regression. Mean %SL based on *T. crossotus* alone. P-values indicate significance levels for contrasts among Y-intercepts that are significantly different between this species and *S. rubrivinctus* (n = 3).

Measured Variable	Mean %SL(Min-Max)	(α + αi)	β	S.E.	Probability
Head Length:	45.7(44.8-47)	2.03-1.11	0.415	0.386	P < 0.001**
Snout Length:	11.2(10.8-11.5)	0.111+0.00	0.117	0.24	P < 0.05*
Orbit Diameter:	14.2(14.1-14.5)	1.89-1.05	0.1	0.26	
Interorbital Width:	6.05(5.02-7.01)	0.593-0.596	0.047	0.185	P < 0.05*
Jaw Length:	19.5(18.9-20.6)	0.217-0.253	0.21	0.252	
Postorbital Length:	21.1(20.2-22)	0.289-0.156	0.208	0.31	
Greatest Body Depth:	39.4(38.7-39.9)	1.18-3.1	0.342	0.552	P < 0.001**
Predorsal Length:	42.8(41.2-45.2)	1.79-0.211	0.397	0.452	
Anal Fin Length:	29.8(28.1-31.9)	2.13-1.49	0.256	0.451	
Caudal Fin Length:	25.9(19.9-29.7)	1.13-1.09	0.247	0.746	
Pectoral Fin Length:	37.3(27.7-45.3)	3-0.941	0.275	1.41	
Pelvic Fin Length:	28.1(27-29.2)	0.747-0.256	0.234	1.11	
First Dorsal Spine Length (D1):	8.81(7.96-9.6)	0.822-0.874	0.059	0.363	
Second Dorsal Spine Length (D2):	14(12-15.1)	1.51-1.52	0.092	0.472	
Third Dorsal Spine Length (D3):	17.9(15.9-19.8)	2.08-2.1	0.116	0.423	
Fourth Dorsal Spine Length (D4):	18.1(16.2-19)	2.02-1.95	0.124	0.397	
Fifth Dorsal Spine Length (D5):	17.7(16.5-18.9)	1.71-1.48	0.122	0.526	
Penultimate Dorsal Spine Length (PDS):	8.58(7.2-9.94)	-0.794	0.067	0.334	
Last Dorsal Spine Length (LDS):	10.5(9.05-11.8)	0.255-0.71	0.104	0.379	
First Anal Spine Length:	10.6(8.94-11.4)	-0.586	0.088	0.357	
Second Anal Spine Length:	24.2(22.7-26.1)	-0.197	0.202	0.427	
Third Anal Spine Length:	17.9(16.9-19.1)	-0.222	0.163	0.309	
Caudal Peduncle Depth:	10.5(10.2-10.7)	0.29-0.256	0.097	0.162	P < 0.05*
Snout Tip to Base of D2:	44.1(42.2-46.4)	1.92-0.325	0.408	0.459	
Snout Tip to Base of D3:	46.9(44.8-49)	2.11-0.601	0.434	0.583	
Snout Tip to Base of D4:	50.6(49.2-52.2)	2-0.829	0.471	0.559	
Snout Tip to Base of D5:	55(53.2-57.2)	2.06-0.967	0.501	0.524	
Tip of D4 to Fin-Membrane:	10.7(9.81-11.2)	1.44-1.56	0.059	0.301	
Snout Tip to Pelvic Fin Insertion:	46(43-50.7)	1.84-0.976	0.399	0.738	
D1 Base to D5 Base:	14.1(13-15.1)	0.533-0.866	0.125	0.353	
D5 Base to Pelvic Fin Insertion:	40.9(40.6-41.1)	1.21-2.77	0.365	0.586	P < 0.001**
D1 Base to Pelvic Fin Insertion:	39.8(39.3-40.5)	0.855-2.82	0.361	1.01	
D5 Base to LDS:	28.3(25.6-32.2)	-1.32	0.287	0.771	
LDS Base to Last Dorsal Ray Base (LDR):	20.6(18.5-21.8)	-1.315	0.183	0.579	P < 0.001**
LDR Base to Last Anal Ray (LAR):	14.5(13.5-15.8)	-0.953	0.161	0.457	
Anal Fin Origin to LAR:	13.8(12.2-14.8)	0.58-1.38	0.136	0.627	
Pelvic Fin Insertion to Anal Fin Origin:	32.7(30.6-36.8)	-2.79	0.377	0.756	
D1 Base to Anal Fin Origin:	57.2(55.2-59.7)	-2.288	0.507	0.612	P < 0.001**
LDS Base to Pelvic Fin Insertion:	47.3(44.3-51.7)	-1.774	0.477	0.707	
LDS Base to Base of LAR:	29.7(28-30.7)	-1.431	0.253	0.418	P < 0.001**
LDR Base to Anal Fin Origin:	25.1(23.4-27.5)	0.304-1.31	0.25	0.444	
LDS Base to Anal Fin Origin:	33.2(31.4-34.4)	0.2-1.99	0.28	0.615	P < 0.001**
D5 Base to Anal Fin Origin:	49.2(48.1-50.8)	-2.089	0.436	0.498	P < 0.001**

TABLE 6. Summary of regression statistics for body measures of *T. evides* based on a pooled parallel slopes model of regression. Mean %SL based on *T. evides* alone. P-values indicate significance levels for contrasts among Y-intercepts that are significantly different between this species and *S. rubrivinctus* (n = 6).

Measured Variable	Mean %SL(Min-Max)	(α + αi)	β	S.E.	Probability
Head Length:	41.4(40.9-42.2)	2.03-1.11	0.415	0.271	P < 0.001**
Snout Length:	10.2(9.87-10.5)	0.111+0.00	0.117	0.169	P < 0.001**
Orbit Diameter:	13.7(13.0-14.3)	1.89-1.05	0.1	0.183	
Interorbital Width:	5.11(4.73-6.07)	0.593-0.596	0.047	0.13	
Jaw Length:	21.4(20.3-22.1)	0.217-0.253	0.21	0.177	
Postorbital Length:	18.7(17.6-20.4)	0.289-0.156	0.208	0.218	
Greatest Body Depth:	35.4(33.0-37.6)	1.18-3.1	0.342	0.388	
Predorsal Length:	40.5(38.9-41.2)	1.79-0.211	0.397	0.318	P < 0.001**
Anal Fin Length:	30.0(27.0-33.0)	2.13-1.49	0.256	0.317	
Caudal Fin Length:	27.7(25.6-29.1)	1.13-1.09	0.247	0.524	
Pectoral Fin Length:	32.5(25.2-36.6)	3-0.941	0.275	0.993	
Pelvic Fin Length:	26.4(24.9-28.3)	0.747-0.256	0.234	0.778	
First Dorsal Spine Length (D1):	7.08(5.61-7.77)	0.822-0.874	0.059	0.255	
Second Dorsal Spine Length (D2):	11.2(8.88-12.9)	1.51-1.52	0.092	0.332	P < 0.05*
Third Dorsal Spine Length (D3):	14.2(13.0-15.1)	2.08-2.1	0.116	0.297	P < 0.05*
Fourth Dorsal Spine Length (D4):	15.1(13.7-16.5)	2.02-1.95	0.124	0.279	P < 0.05*
Fifth Dorsal Spine Length (D5):	15.5(14.3-16.5)	1.71-1.48	0.122	0.369	
Penultimate Dorsal Spine Length (PDS):	6.79(5.58-7.74)	-0.794	0.067	0.235	
Last Dorsal Spine Length (LDS):	11.1(9.32-12.1)	0.255-0.71	0.104	0.266	
First Anal Spine Length:	7.57(6.45-8.48)	-0.586	0.088	0.251	
Second Anal Spine Length:	20.9(19.7-22.3)	-0.197	0.202	0.3	
Third Anal Spine Length:	17.0(16.2-17.4)	-0.222	0.163	0.217	
Caudal Peduncle Depth:	11.2(10.1-12.2)	0.29-0.256	0.097	0.114	P < 0.05*
Snout Tip to Base of D2:	42.0(40.2-43.8)	1.92-0.325	0.407	0.323	P < 0.001**
Snout Tip to Base of D3:	45.2(42.8-47.0)	2.11-0.601	0.434	0.409	P < 0.001**
Snout Tip to Base of D4:	48.6(46.5-51.7)	2.00-0.829	0.471	0.393	P < 0.001**
Snout Tip to Base of D5:	53.0(50.8-55.0)	2.06-0.967	0.51	0.368	P < 0.05*
Tip of D4 to Fin Membrane:	6.88(6.03-8.46)	1.44-1.56	0.059	0.211	P < 0.001**
Snout Tip to Pelvic Fin Insertion:	41.5(39.7-45.2)	1.84-0.976	0.399	0.518	
D1 Base to D5 Base:	14.1(12.5-15.7)	0.533-0.866	0.125	0.248	
D5 Base to Pelvic Fin Insertion:	38.3(35.9-40.5)	1.21-2.77	0.365	0.412	
D1 Base to Pelvic Fin Insertion:	35.5(33.4-38.6)	0.855-2.82	0.361	0.712	
D5 Base to LDS:	28.9(26.8-30.3)	-1.32	0.287	0.542	
LDS Base to Last Dorsal Ray Base (LDR):	18.5(17.2-19.9)	-1.315	0.183	0.407	
LDR Base to Last Anal Ray (LAR):	16.4(15.0-17.2)	-0.953	0.161	0.321	P < 0.05*
Anal Fin Origin to LAR:	15.4(14.2-16.7)	0.58-1.38	0.136	0.44	
Pelvic Fin Insertion to Anal Fin Origin:	32.1(30.5-34.8)	-2.79	0.377	0.531	
D1 Base to Anal Fin Origin:	50.5(48.1-51.7)	-2.288	0.507	0.43	P < 0.05*
LDS Base to Pelvic Fin Insertion:	47.4(45.6-49.3)	-1.774	0.477	0.497	
LDS Base to Base of LAR:	26.5(25.6-27.7)	-1.431	0.253	0.293	P < 0.05*
LDR Base to Anal Fin Origin:	27.6(26.6-28.7)	0.304-1.31	0.25	0.312	
LDS Base to Anal Fin Origin:	28.8(27.5-30.0)	0.20-1.99	0.28	0.432	
D5 Base to Anal Fin Origin:	43.2(41.3-44.8)	-2.089	0.436	0.35	P < 0.05*

TABLE 7. Summary of regression statistics for body measures of *Scorpaenodes littoralis* based on a pooled parallel slopes model of regression. Mean %SL based on *S. littoralis* alone. P-values indicate significance levels for contrasts among Y-intercepts that are significantly different between this species and *S. rubrivinctus* (n = 28).

Measured Variable	Mean %SL(Min-Max)	($\alpha + \alpha i$)	β	S.E.	Probability
Head Length:	42.7(39.6-44.8)	2.03-1.11	0.415	0.149	P < 0.001**
Snout Length:	10.2(9.3-11.3)	0.111+0.00	0.117	0.092	P < 0.001**
Orbit Diameter:	12.9(10.7-14.9)	1.89-1.05	0.1	0.1	P < 0.001**
Interorbital Width:	5.07(4.07-5.94)	0.593-0.596	0.047	0.071	
Jaw Length:	22.2(19.9-23.9)	0.217-0.253	0.21	0.097	P < 0.001**
Postorbital Length:	19.7(16.2-21.7)	0.289-0.156	0.208	0.12	
Greatest Body Depth:	34.2(30.9-37.4)	1.18-3.1	0.342	0.213	
Predorsal Length:	40.0(37.2-42.6)	1.79-0.211	0.397	0.174	P < 0.001**
Anal Fin Length:	29.5(25.5-32.8)	2.13-1.49	0.256	0.174	
Caudal Fin Length:	27.4(24.3-29.8)	1.13-1.09	0.247	0.287	
Pectoral Fin Length:	32.0(26.6-37.8)	3-0.941	0.275	0.544	
Pelvic Fin Length:	25.1(8.21-29.1)	0.747-0.256	0.234	0.427	
First Dorsal Spine Length (D1):	7.23(5.97-13.0)	0.822-0.874	0.059	0.14	
Second Dorsal Spine Length (D2):	11.5(9.41-18.1)	1.51-1.52	0.092	0.182	P < 0.05*
Third Dorsal Spine Length (D3):	14.4(12.1-19.8)	2.08-2.1	0.116	0.163	P < 0.001**
Fourth Dorsal Spine Length (D4):	15.1(12.7-18.8)	2.02-1.95	0.124	0.153	P < 0.001**
Fifth Dorsal Spine Length (D5):	14.7(5.46-18.3)	1.71-1.48	0.122	0.203	
Penultimate Dorsal Spine Length (PDS):	6.18(4.25-10.1)	-0.794	0.067	0.129	
Last Dorsal Spine Length (LDS):	10.4(7.65-12.8)	0.255-0.71	0.104	0.146	P < 0.05*
First Anal Spine Length:	8.11(5.89-10.7)	-0.586	0.088	0.138	P < 0.05*
Second Anal Spine Length:	21.6(18.7-24.3)	-0.197	0.202	0.165	
Third Anal Spine Length:	16.1(14.0-18.0)	-0.222	0.163	0.119	
Caudal Peduncle Depth:	9.68(8.81-10.5)	0.29-0.256	0.097	0.063	
Snout Tip to Base of D2:	41.7(38.1-45.0)	1.92-0.325	0.408	0.177	P < 0.001**
Snout Tip to Base of D3:	45.2(42.3-49.3)	2.11-0.601	0.434	0.225	P < 0.001**
Snout Tip to Base of D4:	49.0(46.1-52.9)	2-0.829	0.471	0.215	P < 0.001**
Snout Tip to Base of D5:	52.7(50.0-57.2)	2.06-0.967	0.51	0.202	P < 0.001**
Tip of D4 to Fin Membrane:	7.25(5.88-9.11)	1.44-1.56	0.059	0.116	P < 0.001**
Snout Tip to Pelvic Fin Insertion:	40.4(37.2-49.5)	1.84-0.976	0.399	0.284	P < 0.05*
D1 Base to D5 Base:	13.1(11.3-15.3)	0.533-0.866	0.125	0.136	
D5 Base to Pelvic Fin Insertion:	36.9(32.3-40.5)	1.21-2.77	0.365	0.226	
D1 Base to Pelvic Fin Insertion:	34.6(31.2-37.8)	0.855-2.82	0.361	0.39	
D5 Base to LDS:	26.0(22.3-31.9)	-1.32	0.287	0.297	
LDS Base to Last Dorsal Ray Base (LDR):	16.2(13.6-22.4)	-1.315	0.183	0.223	
LDR Base to Last Anal Ray (LAR):	13.9(11.7-17.1)	-0.953	0.161	0.176	
Anal Fin Origin to LAR:	14.1(12.2-15.7)	0.58-1.38	0.136	0.241	
Pelvic Fin Insertion to Anal Fin Origin:	35.0(30.0-39.8)	-2.79	0.377	0.291	P < 0.05*
D1 Base to Anal Fin Origin:	48.4(33.9-52.1)	-2.288	0.507	0.236	P < 0.05*
LDS Base to Pelvic Fin Insertion:	46.2(43.3-50.8)	-1.774	0.477	0.272	
LDS Base to Base of LAR:	23.1(14.7-28.9)	-1.431	0.253	0.161	
LDR Base to Anal Fin Origin:	24.7(13.2-27.6)	0.304-1.31	0.25	0.171	
LDS Base to Anal Fin Origin:	26.0(13.2-29.6)	0.2-1.99	0.28	0.237	
D5 Base to Anal Fin Origin:	40.7(36.5-43.5)	-2.089	0.436	0.192	P < 0.001**

TABLE 8. Summary of regression statistics for body measures of *Scorpaenodes smithi* based on a pooled parallel slopes model of regression. Mean %SL based on *S. smithi* alone. P-values indicate significance levels for contrasts among Y-intercepts that are significantly different between this species and *S. rubrivinctus* (n = 8).

Measured Variable	% SL (Min - Max)	(α+ αi)	β	S. E.	Probability
Head Length:	42.9(40.5-44.2)	2.03-1.11	0.415	0.244	P < 0.001**
Snout Length:	12(10.1-13.2)	0.0718+0.00	0.117	0.151	
Orbit Diameter:	13.3(12.1-14.9)	1.9-1.05	0.1	0.166	P < 0.001**
Interorbital Width:	6.96(6.13-7.68)	0.445-0.578	0.047	0.121	P < 0.001**
Jaw Length:	22.4(21.6-23.6)	0.381-0.265	0.21	0.165	
Postorbital Length:	19.9(18.5-20.8)	0.409-0.168	0.208	0.194	P < 0.001**
Greatest Body Depth:	40.3(37.2-42.8)	1.03-3.09	0.342	0.359	P < 0.001**
Predorsal Length:	41.9(39.9-44.6)	1.89-0.214	0.397	0.301	P < 0.05*
Anal Fin Length:	31.3(29.6-33.4)	2.18-1.49	0.256	0.284	
Caudal Fin Length:	26.8(25.1-29.5)	1.28-1.1	0.247	0.465	
Pectoral Fin Length:	29.6(27.1-33)	3.04-0.945	0.275	0.874	P < 0.05*
Pelvic Fin Length:	26(24.9-27.8)	0.9-0.278	0.234	0.685	
First Dorsal Spine Length (D1):	8.53(7.93-10.3)	0.828-0.875	0.059	0.227	
Second Dorsal Spine Length (D2):	11.6(9.14-13.1)	1.48-1.51	0.092	0.295	
Third Dorsal Spine Length (D3):	15.5(13.4-17.7)	2.14-2.11	0.116	0.265	
Fourth Dorsal Spine Length (D4):	16.4(13.4-18.9)	2.07-1.97	0.124	0.261	
Fifth Dorsal Spine Length (D5):	16.2(15.3-17.3)	1.68-1.49	0.122	0.336	
Penultimate Dorsal Spine Length (PDS):	4.95(3.47-7.46)	-1.029	0.067	0.218	P < 0.05*
Last Dorsal Spine Length (LDS):	10.2(8.91-12.4)	0.236-0.710	0.104	0.234	
First Anal Spine Length:	3.79(3.07-4.21)	-0.568	0.088	0.224	P < 0.001**
Second Anal Spine Length:	14.7(14-15.3)	-0.195	0.202	0.275	P < 0.001**
Third Anal Spine Length:	14.2(11.9-15.3)	0.02+0.00	0.163	0.2	P < 0.001**
Caudal Peduncle Depth:	11.2(10.6-12.3)	0.323-0.255	0.097	0.104	P < 0.05*
Snout Tip to Base of D2:	42.5(40.3-45.5)	2.12-0.342	0.408	0.304	P < 0.001**
Snout Tip to Base of D3:	45.6(42.4-49.1)	1.93-0.583	0.434	0.406	P < 0.05*
Snout Tip to Base of D4:	49.5(47.6-51.5)	1.77-0.803	0.471	0.387	P < 0.05*
Snout Tip to Base of D5:	53.5(51.5-54.9)	1.81-0.934	0.51	0.377	P < 0.05*
Tip of D4 to Fin Membrane:	8.21(7.48-9.04)	1.39-1.55	0.059	0.187	P < 0.05*
Snout Tip to Pelvic Fin Insertion:	44(39.2-53.8)	1.97-0.992	0.399	0.462	
D1 Base to D5 Base:	14.7(13.2-16)	0.48-0.847	0.125	0.23	P < 0.05*
D5 Base to Pelvic Fin Insertion:	42.5(40.1-46.2)	1.17-2.77	0.365	0.378	P < 0.001**
D1 Base to Pelvic Fin Insertion:	40.2(38.3-42.8)	1.01-2.83	0.361	0.632	
D5 Base to LDS:	26.2(23.7-30.4)	-1.18	0.287	0.479	
LDS Base to Last Dorsal Ray Base (LDR):	17.2(15.6-18.6)	-1.261	0.183	0.367	
LDR Base to Last Anal Ray (LAR):	15.6(13.6-17)	-0.962	0.161	0.288	P < 0.05*
Anal Fin Origin to LAR:	15.9(14.2-17.6)	0.763-1.39	0.136	0.39	
Pelvic Fin Insertion to Anal Fin Origin:	32.6(25.7-39.6)	-2.79	0.377	0.489	
D1 Base to Anal Fin Origin:	50.1(48.7-52)	-2.621	0.507	0.431	
LDS Base to Pelvic Fin Insertion:	49.1(43.6-53.1)	-2.016	0.477	0.451	P < 0.05*
LDS Base to Base of LAR:	25.5(23.2-27.5)	-1.57	0.253	0.271	P < 0.05*
LDR Base to Anal Fin Origin:	28.3(25.7-29.9)	0.334-1.31	0.25	0.275	P < 0.001**
LDS Base to Anal Fin Origin:	29.9(27.8-31.8)	-2.0038	0.28	0.389	
D5 Base to Anal Fin Origin:	42.2(40.8-43.7)	-2.129	0.436	0.312	

TABLE 9. Largest 10 positive and 10 most negative loadings on first size-adjusted principal component among 43 original measured variables used to compute size-adjusted principal components analysis. Original variables with relatively low, non-coincident, loadings on size-adjusted eigenvectors not shown. Note that same variables indicate significant differences among species, when regressed against standard length.

Measured Variable	PC I	PC II	PC III
First Anal Spine Length	0.0573	-0.0972	-0.0011
Second Anal Spine Length	0.0363	-0.0353	0.0013
Pelvic Fin Insertion to Anal Fin Origin	0.0342	0.0022	0.0004
Snout Length	0.0317	0.0056	0.0211
Postorbital Length	0.0282	0.0081	0.0128
Third Anal Spine	0.0268	-0.0129	-0.0013
Predorsal Length	0.0243	0.0074	0.0091
Snout Tip to Base of Second Dorsal Spine	0.0235	0.0052	0.01
Snout Tip to Base of Third Dorsal Spine	0.0203	0.0041	0.0095
Pelvic Fin Length	0.0192	0.0193	-0.0105
Greatest Body Depth	-0.0197	0.0142	-0.0074
Anal Fin Origin to Base of Last Anal Ray	-0.0207	0.0115	-0.0089
Last Dorsal Spine Length	-0.0221	-0.0198	-0.0087
Fifth Dorsal Spine Length	-0.0318	-0.0095	0.0105
Second Anal Spine Length	-0.0382	-0.0166	0.0141
Penultimate Dorsal Spine Length	-0.0338	-0.0413	-0.0726
Fourth Dorsal Spine Length	-0.0393	-0.0221	0.0166
Third Dorsal Spine Length	-0.0432	-0.0223	0.0122
First Dorsal Spine Length	-0.0491	-0.007	0.0227
Tip of Fourth Dorsal Spine to Fin Membrane	-0.0649	-0.0317	0.0344

TABLE 10. Loadings for variables of largest 3 principal components derived from countable features accounting for 88.3% of the total variation in the sample (PC I – 58.0%; PC II — 18.5%; PC III – 11.8%).

Counted Variable	PC I	PC II	PC III
Dorsal fin-rays	0.4797	0.8098	0.3267
Mean Pectoral Fin Rays (Left+Right/2)	0.8306	-0.3721	0.1307
Mean Gill Rakers (Left+Right/2)	0.7833	-0.3313	0.4186
Vertical Scale Rows	0.8531	0.1128	-0.2666
Mean Lateral Line Scales (Left+Right/2)	0.8065	0.104	-0.4535

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Four New Gobiid Fishes of the Genus *Eviota* from the Western Pacific, with Clarification of *Eviota guttata* and *Eviota albolineata* (Teleostei: Gobiidae)

David W. Greenfield[1,3] and John E. Randall[2]

[1] *California Academy of Sciences, 55 Music Concourse Dr., Golden Gate Park, San Francisco, California 94118-4599; Email: greenfie@hawaii.edu.* [2] *Bishop Museum, 1525 Bernice Street, Honolulu, Hawaii 96817-2704*

Four new species of the Indo-Pacific gobiid fish genus *Eviota* are described: *E. toshiyuki* from the Ryukyu and Ogasawara Islands (previously misidentified as *E. epiphanes*); *E. winterbottomi* from Vietnam, Palau, and Komodo; *E. rubrisparsa* from Christmas Island (Indian Ocean) and New Britain, with underwater photographs from Indonesia, Papua New Guinea, and the Solomon Islands; and *E. shimadai* from the Ogasawara Islands, Palau, and Bali. The first three species fall in Group I of Lachner and Karnella (1980), and the fourth in their Group IV. A comparison is provided of the similar species *Eviota guttata* Lachner and Karnella, which ranges from the Red Sea (type locality) to the Samoa Islands, and *E. albolineata* Jewett and Lachner from the Society Islands, Tuamotu Archipelago, and the Line Islands.

The literature on the tiny fishes of the gobiid genus *Eviota* consists mainly of descriptive papers with little or no information on the life color, and semi-popular guidebooks or articles with color illustrations but generally lacking morphological data. During the second author's many field trips within the Indo-Pacific region, a special effort was made to take underwater photographs of species of *Eviota* and then collect the photographed fish and others like it with the use of the anesthetic quinaldine. We began our research on these specimens with a new species described as *Eviota tigrina* from Tonga (Greenfield and Randall 2008).

We describe four species here, the first, *E. toshiyuki*, known only from the Ryukyu and Ogasawara Islands (formerly misidentified as *E. epiphanes*); the second, *E. winterbottomi*, from a specimen first collected from the island of Komodo in Indonesia by the second author but described here with more material collected by Richard Winterbottom and colleagues from Vietnam; the third species, *E. shimadai*, is represented by specimens from the Ogasawara Islands, Ryukyu Islands, Palau, and Bali; and the fourth species, *E. rubrisparsa*, from four specimens from Christmas Island (Indian Ocean) and one from New Britain. We also report *E. rubrisparsa* from underwater photographs from localities in Indonesia (Alor, Flores, and West Papua), New Guinea (D'Entrecasteaux Islands), and the Solomon Islands. The species has previously been misidentified as the similar *Eviota albolineata* Jewett and Lachner 1983, itself long confused with *E. guttata* Lachner and Karnella 1978. The latter ranges from the Red Sea (type locality) east to the islands of Micronesia and

[3] Research Associate, Department of Ichthyology, California Academy of Sciences and Emeritus Professor, University of Hawaii. Mailing address: 944 Egan Ave., Pacific Grove, CA 93950.

the Samoa Islands. *Eviota albolineata* is recorded only from the Society Islands (type locality, Tahiti), Line Islands, and the Tuamotu Archipelago.

Materials and Methods

Counts and measurements, descriptions of fin morphology and the cephalic sensory-canal pore patterns follow Lachner and Karnella (1980). Measurements were made to the nearest 0.1 mm using dial calipers and an ocular micrometer and are presented as percentage of standard length (SL). Cyanine Blue 5R (acid blue 113) stain was used to make pores more obvious (Akihito et al. 1993; Saruwatari et al. 1997; Nakabo 2002). Values for the holotype are given first, followed by the range for all types and by the arithmetic mean, where appropriate, in parentheses. Photographs of preserved specimens are shown in Figure 37 to aid in the recognition of museum specimens. Institutional abbreviations are as listed in Leviton et al. (1985).

Species Descriptions

***Eviota toshiyuki* Greenfield and Randall, sp. nov.**
Figures 1–2, 37A.

Eviota epiphanes (non Jenkins). Masuda et al. 1984, 243, pl. 237-D (southern Japan); Randall et al. 1997, 56, pl 17B (Ogasawara Islands) (Fig. 2 here); Nakabo 2002, 1177, 1282, & 1604 (Ryukyu Islands and Ogasawara Islands to Kochi Prefecture).

Material Examined.— Holotype: OMNH-P 35366, 18.0 mm SL, female, Japan, Ogasawara Islands, Chichi-jima Island, Miyanohama Beach, 27°06′01.23″ N, 142°11′51.6″ E, 8 m, hand net, T. Suzuki and M. Hosokawa. Paratypes: NSMT-P 94747, 14.1 mm SL, male, taken with holotype; BPBM 35204(2), 11.8–17.8 mm SL, Japan, Ogasawara Archipelago, Chichi-jima, south side, cave, 3–4 m, rotenone, J.E. Randall, J.L. Earle, and H. Ida, 25 July 1991; CAS 227276, 15.3 mm SL, collected with BPBM 35204; USNM 396531, 12.2 mm SL, collected with BPBM 35204.

Diagnosis.— The following combination of characters distinguishes *E. toshiyuki* from congeners: dorsal/anal fin-ray formula 9/8; 17 pectoral-fin rays, some branched; cephalic sensory-pore system pattern I (complete); 5th segmented pelvic-fin ray absent; pelvic-fin membranes not well-developed; branches on 4th pelvic-fin ray 5–9; genital papilla non-fimbriate; first two spines of dorsal fin filamentous; body slender 17.9–22.2% SL; pectoral-fin base with two distinctive dark spots; subcutaneous dark spot midlaterally at posterior end of caudal peduncle.

Description.— Dorsal-fin rays VI+I-9; anal-fin rays I,8; pectoral-fin rays 17, rays 11–15 branched in holotype; pelvic-fin rays I,4; branches on 4th pelvic-fin ray 9 (5–9), 1 or 2 (1–4) segments between branches; 12 (12–13) branched caudal-fin rays; segmented caudal-fin rays 17 (16–17); lateral scale rows 25 (24–25); transverse scale rows 7; breast scaleless; first dorsal fin of holotype filamentous 31.1 % SL (male paratype = 39.7 % SL); pelvic fins reaching to anus or genital papilla; cephalic sensory-pore system pattern I (complete); male genital papilla non-fimbriate.

Measurements (based on holotype and five paratypes): Standard length 11.8–18.0 mm; head length 28.9 (27.4–31.6, 29.7); origin of first dorsal fin 35.3 (34.0–36.2, 35.3); origin of second dorsal fin 57.8 (54.8–57.8, 56.8); origin of anal fin 60.0 (57.4–63.9, 60.4); caudal-peduncle length 21.7 (21.5–24.1, 22.2); caudal-peduncle depth 14.4 (10.7–14.4, 12.7); body depth 22.2 (17.9–22.2, 20.1); eye diameter 8.6 (8.6–10.5, 9.4); snout length 5.3 (5.1–7.2, 6.0); pectoral-fin length 27.8 (27.8–33.2, 34.2); pelvic-fin length 30.0 (27.0–30.6, 29.5).

Color in preservative of holotype: Color of head and body pale yellowish. Six internal dark brown spots running from anal-fin origin back to caudal-fin base. A black internal spot at center of

posterior end of caudal peduncle. Head crossed by four brown bands, anteriormost just behind eyes and posteriormost in front of first dorsal fin. Side of head with anteriormost head band crossing nape and extending below eye across cheek, and second band from nape across operculum. A brown spot at posteroventral edge of eye, and another brown area at end of jaws. Pectoral-fin base with two brown spots, dorsal and ventral, separated by a light area. Caudal fin crossed by a narrow dark brown band at its base, membranes immaculate, entire fin edged in brown. Pectoral-fin membranes immaculate, rays with scattered melanophores. Pelvic fins immaculate. First dorsal fin with three rows of scattered melanophores crossing fin on lower two thirds, distal one third clear with brown margin. Second dorsal fin with scattered melanophores on lower half, distal half clear with a brown margin. Anal fin with clear rays and brown membranes.

Color of fresh holotype (Fig. 1): Body semi-translucent with yellowish tinge, dark internal blotches along vertebral column and along ventral half of caudal peduncle. Body with a lengthwise row of six black blotches along side on and above midline and a row of eight below midline. Posteriormost spots of two rows joined towards end of caudal peduncle to form a bar. Another narrower brownish-black bar at end of hypural plate. Scale pockets on sides with dark brown pigment, forming spindles. Four black bars across top of head and nape between eyes and first dorsal fin. Pectoral-fin base with two brown blotches separated by a silver-white bar. Side of head with two major dark brown bars, one at operculum and second on cheek, both connecting dorsally to bars on top of the head. A small black spot posterodorsally to eye, a second running from ventral portion of eye to upper jaw, and a third at posterior end of jaws. Area between these dark markings silver-white with a bluish tinge, being most intense from eye down across the two jaws. Jaws and snout light brown with some silver-white areas. Pupil of eye black, iris red-orange. Pectoral fins immaculate. Pelvic fins white with brown on segments. Posterior margin of caudal fin blackish, membranes clear, and a scattering of melanophores on basal two thirds. Anal fin dusky with margin of black, red-orange line extending down from body bars onto bases of second and sixth fin rays. First dorsal fin with three evenly spaced dark spots extending up from body onto fin a short distance; filamentous first spine with eight evenly spaced red-orange spots; two rows of larger red-orange spots crossing center of fin within a band of scattered melanophores; distal third of fin with clear rays and membranes; margin of fin edged in black. Second dorsal fin with five evenly spaced spots extending up from body onto bases of fin rays; four rows of red-orange spots crossing fin; a scattering of melanophores on basal one-third and distal third, leaving the middle third lighter; distal margin of fin edged in black.

Etymology.— The specific epithet is a patronym, a noun in the Latin genitive case, in honor of Toshiyuki Suzuki who collected the holotype and a paratype and has been most helpful in providing photographs and specimens of *Eviota* species. We have used the name *toshiyuki* instead of *suzuki* because many in Japan have the surname Suzuki.

Comparisons.— *Eviota toshiyuki* has a complete cephalic sensory-canal pore configuration, belonging to Group I of Lachner and Karnella (1980), This group contained 22 described species (Shibukawa and Suzuki 2005, Matsuura and Senou 2006, Allen, Steene, and Orchard 2007, Greenfield 2009). With the addition of *E. toshiyuki,* the total is now 23. *Eviota toshiyuki* has a dorsal/anal formula of 9/8, whereas the following species in Group I have different formulas: 8/7 – *E. pardalota* Lachner and Karnella 1978; 8/8 – *E. distigma* Jordan and Seale 1906, *E. herrei* Jordan and Seale 1906, *E. monostigma* Fourmanoir 1971, *E. nebulosa* Smith 1958, *E. nigripinna* Lachner and Karnella 1980, *E. pseudostigma* Lachner and Karnella 1980, and *E. randalli* Greenfield 2009; 10/8–10/9 – *E. abax* (Jordan and Snyder 1901), *E. natalis* Allen 2007 (also 9/8), and *E. masudai* Matsuura and Senou 2006. Of those Group I species with a formula of 9/8, *E. melasma* Lachner and Karnella 1980 and *E. smaragdus* Jordan and Seale 1906 both have a single, promi-

nent dark occipital spot that is lacking in *E. toshiyuki*. *Eviota rubrisparsa* Greenfield and Randall 2010 lacks the two dark spots on the pectoral-fin base that is present in *E. toshiyuki*, as do *E. albolineata*, *E. guttata*, *E. inutilis*, and *E. natalis*. *Eviota toshiyuki* has a filamentous first dorsal fin, whereas the spines of the fin are not filamentous in the following species: *E. disrupta* Karnella and Lachner 1981, *E. epiphanes* Jenkins 1903, *E. fasciola* Karnella and Lachner 1981, *E. irrasa* Karnella and Lachner 1981 and *E. readerae* Gill and Jewett 2004. *Eviota korechika* Shibukawa and Suzuki 2005, also from Japan, lacks the basal caudal spot of *E. toshiyuki*, and the pelvic membrane extends farther posteriorly. *Eviota korechika* has 5–7 diagonal blue bars on the second dorsal and anal fins that are lacking in *E. toshiyuki*.

This species in Japan has been referred to previously as *E. epiphanes*. The most obvious differences between *E. toshiyuki* and *E. epiphanes* are the filamentous first dorsal-fin spines and two dark spots on the pectoral-fin base, both characters absent in *E. epiphanes* (Fig. 3). *Eviota epiphanes* is known only from the Hawaiian Islands, Johnston Island, and the Line Islands.

Remarks.— *Eviota toshiyuki* is very similar in coloration to *E. zonura* (Fig. 4). Although *E. zonura* has been recorded from Japan in the past, Nakabo (2002:1604) considers those records to be of *E. epiphanes* (= *E. toshiyuki* - see above). The great similarity in color, and the fact that the species differ only in the absence of a head pore, suggest that they might be sister species. *Eviota toshiyuki* is known only from Japan, whereas *E. zonura* is known south to Australia and east to the Mariana Islands and Samoa.

Eviota winterbottomi **Greenfield and Randall, sp. nov.**
Figures 5–6, 37B.

Material Examined.— Holotype: ROM 73100, 14.7 mm SL, male, Vietnam, Nha Trang Bay, Hon Rua (Rua Island), south side, eastern margin of island, 12.287°N, 109.245° E, 0–6 m, rotenone, field number RW02-07, R. Winterbottom et al., 15 May 2002. Paratypes: ROM 84607, 15.0 mm SL, female, taken with holotype; ROM 74566, 13.1 mm SL female, 14.8 mm SL, male, Vietnam, Nha Trang Bay, Hon Mun (Mun Island), northeast tip, 12.169°N, 109.312° E, 9–12 m, rotenone, field number RW02-16, R. Winterbottom et al., 22 May 2002; ROM 74565, 10.8 mm SL, immature, Vietnam, Nha Trang Bay, Hon Mun (Mun Island), north side at mid-point of island, 12.172° N, 109.300° E, 0–3 m, rotenone, field number RW02-15, R. Winterbottom et al., 21 May 2002; ROM 74567, 15.6 mm SL, male, Vietnam, Nha Trang Bay, Hon Mun (Mun Island), east side, 12.171° N, 109.312°E, 0–7 m, rotenone, field number RW02-25, R. Winterbottom et al., 21 May 2002; CAS 227274, 14.8 mm SL, male, 16.4 mm SL, female, taken with ROM 74567; BPBM 40982, 15.5 mm SL, male, taken with ROM 74567; USNM 396529, 16.2 mm SL, male, Vietnam, Nha Trang Bay, Hon Mun (Mun Island), northeast side, 12.191° N, 109.342° E, 12–30 m, rotenone, field number RW02-24, R. Winterbottom et al., 26 May 2002; USNM 396530, 15.8 mm SL, female, Vietnam, Nha Trang Bay, Hon Mun (Mun Island), southeast side near rocky islets, 12.176° N, 109.279° E, 0–5 m, rotenone, field number RW02-26, R. Winterbottom et al., 27 May 2002. NON TYPES: ROM 84608 (3), 10.1–10.3, taken with ROM 74567; ROM 80693, 12.9 mm SL, female, Palau, north tip of barrier reef off Babeldaob Island, 7.999°N, 109.245°E, 14–18.4 m, rotenone, field number RW06-20, W. Holleman, M. Winterbottom, M. Westneat, J. Cooper, & A. Rice, 29 March 2006; BPBM 38789(2), 15.1–15.6 mm SL, Komodo, Indonesia, 30.5m, quinaldine, J.E. Randall, 9 September, 2000.

Diagnosis.— The following combination of characters distinguishes *E. winterbottomi* from congeners: dorsal/anal fin-ray formula 8/8; 6–7 branched pectoral-fin rays; cephalic sensory-pore system pattern I (complete); 5th segmented pelvic-fin ray absent; branches on 4th pelvic-fin ray 3–6; genital papilla non-fimbriate; first dorsal fin not filamentous; body slender 18.8–23.6% SL; body with spindle-shaped black lines (from black pigment in scale-pocket tissue); anal fin pigmented; three dark marks on ventral surface of caudal peduncle and two more on anal-fin base in preserved specimens; six internal black blotches on sides when alive.

Description.— Dorsal-fin rays VI+I,8; anal-fin rays I,8; pectoral-fin rays 15 (15–17), with rays 10–15 branched (8–14); pelvic-fin rays I,4, 5th ray absent; 5 branches on 4th segmented pelvic-fin ray (3–6), 3–4 segments between consecutive branches (3–4); pelvic-fin membrane reduced; branched caudal-fin rays 12 (12–14); segmented caudal-fin rays 17; lateral scale rows 24 (23–24); transverse scale rows 7; breast scaleless; first dorsal fin of male not filamentous (see discussion); pelvic fins reaching to genital papilla; male genital papilla non-fimbriate; cephalic sensory-pore system pattern I (complete).

Measurements (based on holotype and 10 paratypes): Standard length 10.8–16.4; head length 31.9 (28.3–31.9; 30.3); origin of first dorsal fin 36.6 (32.8–38.4; 35.7); origin of second dorsal fin 57.6 (53.1–60.8; 56.8); origin of anal fin 58.3 (55.4–63.1; 59.4); caudal-peduncle length 25.1 (20.5–28.2; 23.9); caudal-peduncle depth 14.9 (12.0–16.2; 13.9); body depth 21 (18.8–23.6; 21.4); eye diameter 9.8 (8.5–10.6; 9.6); snout length 6.1 (4.6–6.1; 5.5); pectoral-fin length 33.9 (30.0–39.4; 34.5); pelvic-fin length 28.5 (24.0–38.0; 29.9).

Coloration in preservative: Background color of head and body pale yellowish. Body with vertical dark brown lines (from pigment in scale-pocket tissue) forming spindle or chevron-shaped patterns on back and sides. Three brown bars across nape directly in front of dorsal fin. Two rounded brown blotches behind eye above cheek and operculum. Three blotches below eye and two more on cheek. A peppering of dark brown spots above and behind eyes and on snout, upper and lower jaws light brown. A peppering of small brown spots on upper half of pectoral-fin base. Base of anal fin with two brown spots, one at front and other at back of fin. Three more similar spots along ventral surface of caudal peduncle. Narrow longitudinal dark line on midline of caudal peduncle before caudal-fin base. Internal dark area on caudal peduncle before caudal-fin base (remainder of internal blotch), more intense above midline. Area posterior to caudal-peduncle blotch lighter. Caudal, second dorsal, and anal fins with brown pigment on membranes. Basal two-thirds of first dorsal fin dark brown, a narrow white band above, and then distal one-third black. Pectoral fin peppered with small brown spots. Pelvic fins clear. Pupil of eye clear, iris black.

Color of fresh holotype (Fig. 5): Head and body translucent with internal coloration visible. Six large internal black blotches running down midline of body, posterior one most visible. Spindle or chevron-shaped reddish-brown lines (from pigment in scale-pocket tissue) on sides and back, but not on nape. Reddish-brown spots on head, nape and pectoral-fin base as described for preserved specimen. Pupil of eye black, iris gold with orange. Caudal fin with reddish-brown pigment on rays and membranes. Base of second dorsal fin with reddish-brown spots on spine and rays, smaller spots on membranes.

Two specimens from Komodo, Indonesia (BPBM 38789) agree with the type series of *E. winterbottomi* in counts, measurements, pore pattern, and basic coloration, but the first dorsal fin is filamentous (Fig. 6) whereas it is not in the types from Vietnam or the specimen from Palau. The coloration on the top of the head and snout also is more golden, and the spots on the side of the head more orange. Because of these differences we have included neither the Komodo nor the Palau specimens in the type series because we wished to restrict the types to a specific locality.

Etymology.— The specific epithet is a patronym, a noun in the Latin genitive case, in honor of Richard Winterbottom, who first recognized this new species from specimens he collected in Vietnam, maintains an updated working key to the species in the genus *Eviota*, and provides valuable advice on goby systematics.

Comparisons.— Like *E. toshiyuki*, *E. winterbottomi* has a complete cephalic sensory-pore system (Group I of Lachner and Karnella 1980) bringing the number of species in this group to 24. Only seven of these species share the dorsal/anal fin-ray formula of 8/8 with *E. winterbottomi*: *E. distigma* Jordan and Seale 1906; *E. herrei* Jordan and Seale 1906; *E. monostigma* Fourmanoir

1971; *E. nebulosa* Smith 1958; *E. nigripinna* Lachner and Karnella 1980; *E. pseudostigma* Lachner and Karnella 1980, and *E. randalli* Greenfield 2009. The remainder of the species have a formula of 10/9, 10/8, 9/8 (most), or 8/7. Four of the species with an 8/8 formula have distinctive dark markings on the pectoral-fin base that are lacking in *E. winterbottomi*: *E. distigma, E. monostigma, E. pseudostigma,* and *E. randalli*. *Eviota nigripinna* has a uniformly dark dorsal fin that is lacking in *E. winterbottomi*. *Eviota winterbottomi* is most similar to *E. nebulosa,* but the pectoral-fin base is pale (yellowish in life), whereas it is pigmented in *E. winterbottomi*, the posterior internal blotch in fresh specimens is above the midline in *E. nebulosa*, whereas it extends both above and below the midline in *E. winterbottomi*, and *E. winterbottomi* lacks pigment posterior to the caudal-peduncle blotch that is present in *E. nebulosa*. The remaining species, *E. herrei*, is deep bodied (24.8–28.5% SL at dorsal-fin origin), whereas *E. winterbottomi* is more slender bodied with a depth of 18.8–23.6% SL.

***Eviota shimadai* Greenfield and Randall, sp. nov.**
Figures 7–10, 37C.

Eviota sp. Shimada and Yoshino (1993:4–5, Figs. 11–19).
Eviota sp. 1. Masuda and Kobayashi (1994:339, Fig. 7).
Eviota sp. 4 (Hanaguro-isohaze). Nakabo (2002: 1181, unnumbered Fig.).
Eviota sp. 4. Senou et al. (2004:132, 2 unnumbered Figs.).

Material examined.—Holotype: NSMT-P 94898, 14.5 mm SL, male, Japan, Ryukyu Islands, Hatoma Channel, Iriomote Island, 7 m, hand net, field number S17080, T. Suzuki, M. Suzuki & A. Kawai, 8 July 2008.

Paratypes: OMNH-P34244, 12.3 mm SL, female, taken with holotype; BPBM 35322, 15.1 mm SL, female, Ogasawara Islands, Chichi-jima harbor, 13 m, quinaldine, J.E. Randall, 7 June 1992; BPBM 38653, 10.6 mm SL, male, Indonesia, Bali, northeast coast at Tulamben, 12 m, quinaldine, J.E. Randall, 15 October 1999; CAS 227275, 12.2 mm SL, male, taken with BPBM 38653; BPBM 35173, 12.8 mm SL, male, Ogasawara Islands, Chichi-jima, Futami Bay, 5 m, rotenone, J.E. Randall & J.L. Earle, 23 July 1991; BPBM 35112, 15.6 mm SL, male, Ogasawara Islands, Chichi-jima, Miyanohama Bay, 24–29 m, J.L. Earle, 20 July 1991; ROM 84584(3), 11.3–12.7 mm SL, males, Palau, Hatohobei State, Helen Reef, 25.747°N, 131.4804°E, 0–4 m, rotenone, M. Westneat, 18 September 2008; ROM 84564(6), 8.8–13.7 mm SL, males and females, Palau, Hatohobei State, Helen Reef, 24.342°N, 131.4554°E, 4–8 m, rotenone, M. Westneat, 17 September 2008; ROM 84590, 10.5 mm SL, male, Palau, Hatohobei State, Helen Reef, 25.218°N, 131.4421°E, 9–17 m, rotenone, M. Westneat, 19 September 2008; ROM 84598, 9.6 mm SL, female, Palau, Hatohobei State, Helen Reef, 25.217°N, 131.4523°N, 8–20 m, rotenone, M. Westneat, 20 September 2008. Non-type: BPBM 35114 (1), Ogasawara Islands.

Diagnosis.— The following combination of characters distinguishes *E. shimadai* from congeners: dorsal/anal fin-ray formula usually 8/8, but also 8/7 or 9/8; 16-17 pectoral-fin rays (usually 16), all unbranched; cephalic sensory-pore system pattern IV (lacking pores PITO and IT, and AITO enlarged, engulfing the PITO); 5th segmented pelvic-fin ray variable, absent to 18% of 4th ray; genital papilla non-fimbriate; first dorsal fin filamentous (2nd spine 67.2% SL in holotype); branches on 4th pelvic-fin ray 2–3, 2–3 segments between branches; no obvious large dark marks on body; scattered internal melanophores on side of body under pectoral fin and on side of head; in life a silver bar across central portion of pectoral-fin base.

Description.— Dorsal-fin elements VI+I,9 (8–9); anal-fin elements I,8 (7–8); pectoral-fin rays 17 (16–17), all unbranched; 5th pelvic-fin ray 18% of 4th ray (or absent); branches on 4th pelvic-fin ray 3 (2–3), 3 (2–3) segments between consecutive branches of 4th segmented pelvic-fin ray; branched caudal-fin rays 11; segmented caudal-fin rays 17; lateral scale rows 24 (23–24);

transverse scale rows 7; breast scaleless; first dorsal fins of both males and females filamentous; pelvic fins reaching past anal-fin origin; cephalic sensory-pore system pattern IV; male genital papilla non-fimbriate, pointed with an expanded tip.

Measurements (based on holotype and six paratypes): Standard length 10.6–15.6; head length 33.1 (29.4–33.1, 31.1); origin of first dorsal fin 34.5 (31.1–38.5, 34.6); origin of second dorsal fin 56.6 (55.0–61.1, 57.3); origin of anal fin 56.6 (55.3–60.7, 58.0); caudal-peduncle length 22.8 (20.2–27.1, 23.3); caudal-peduncle depth 13.1 (11.6–15.2, 13.5); body depth 21.7 (19.3–24.4, 21.8); eye diameter 10.3 (9.0–11.3, 10.2); snout length 4.8 (4.0–6.4, 5.1); pectoral-fin length 27.9 (26.2–35.8, 30.0); pelvic-fin length 33.8 (28.2–37.2, 33.5).

Color in preservative (male): Color of body, head and fins white (pale yellowish when preserved longer) with no bold markings. Scattered melanophores on side of head and jaws, more concentrated on upper jaw, under eye, and nostrils. Dark area behind and above eye. Band of scattered melanophores internally on side, covered by pectoral fin, running from pectoral-fin axil to above anus. Black line along ventral surface of caudal peduncle from anal to caudal fin. Female – Same as male except that scattered melanophores present only above and behind eyes, snout and nostrils. Internal melanophores visible behind eyes.

Some specimens from Palau have scattered melanophores extending downward anteroventrally across the pectoral-fin base. Small black spots along the dorsal midline corresponding to red spots in same position on fresh specimens.

Color of fresh specimens (male [holotype, Japan, Fig. 7]): Body translucent, vertebral column silver-blue, with black internal pigment below, most intense on dorsal surface of gut. Head red-orange overlaid with numerous small dark spots, very intense around eye, on upper jaw, nostrils and centrally on operculum. Pupil and iris of eye black, with some areas of red-orange on iris. Pectoral-fin base red-orange with a silver-blue bar crossing at center. A red-orange line extending from upper pectoral-fin base to caudal fin just under the vertebral column and nine short red-orange bars extend dorsally and ventrally. Series of small red-orange spots along dorsal surface from nape, along dorsal-fin bases and onto caudal fin. Caudal fin clear with small red-orange spots on rays, and scattering of melanophores on ventral half and distal margin of membrane. Anal and pelvic fins with yellowish rays and scattered melanophores. First dorsal fin with small red-orange spots on first four elongate spines, the remainder of spines yellow; entire fin covered with scattered melanophores. Second dorsal fin with two rows of small red-orange spots crossing first seven elements and four rows on remaining elements, entire fin covered with scattered melanophores. Pectoral fins immaculate.

Male (paratype ROM 84590, Palau, Fig. 8): Color as above except that dark pigment on head not as intense, dark red stripe behind eye more obvious, and red-orange pigment not as red.

Female (paratype OMNH-P34244, Fig. 9): Color of body and fins as in the male. Head lacks intense small black spots around eye and on side of head. Nostrils are red-orange instead of black, jaws yellow without black pigment and area under eye and posterior to pelvic-fin origin white. Small patch of internal melanophores on cheek behind eye.

Color in life of female (paratype BPBM 35322, Fig. 10): Head and body translucent with internal coloration visible. A lateral reddish purple band running from the snout, nostrils, and head and along ventral half of body, narrowing towards posterior half, with six lines extending down from midline to ventral surface. Series of similar colored spots running along back from head, along fin bases, and onto caudal peduncle. The most distinctive coloration is a silver-blue rectangular bar across central portion of pectoral-fin base (no traces of the bar are visible in preserved material). In addition, there is a series of silver-blue spots to bars along body. One row is along the vertebral column interspersed with purple dashes. Another row of lines of silver-blue bars or spots runs from

behind eye along midline to above anus. Narrow silver-blue line runs from between eyes back to nape. Eye has a black pupil, a silver-gold iris, and three reddish purple stripes through eye, one dorsally, one at pupil, and the third ventrally. Ventral half of the head and breast are clear.

Etymology.— The specific epithet is a patronym, a noun in the Latin genitive case, in honor of Kazuhiko Shimada, who previously recognized this species in Japan as being undescribed.

Comparisons.— *Eviota shimadai* fits the description of the Group IV species-group of Lachner and Karnella (1980), except that the fifth pelvic-fin ray is absent or up to 18% instead of being more than one-half the length of the fourth ray, and specific color markings on the posterior trunk and fins present in other species in that group are lacking in preservative. There are only five other species in that group: *E. bifasciata* Lachner and Karnella 1980, *E. lachdeberei* Giltay 1933, *E. nigriventris* Giltay 1933, *E. partimacula* Randall 2008, and *E. raja* Allen 2001. *Eviota nigriventris* has a distinctive dark stripe along the ventral side of the body, *E. bifasciata* and *E. raja* have two dark stripes, one along the ventral surface and the other along the dorsal surface of the sides, and *E. lachdeberei* and *E. partimacula* have a dark mark at the caudal-fin base. All of these markings are absent in *E. shimadai*. Because of the lack of both the PITO and IT pores this species fits into Group IV, but the species looks very similar to *E. sigillata* Jewett and Lachner 1983 when alive. It is only the absence of the PITO pore that moves it to Group IV instead of being in Group III. Preserved specimens of *E. sigillata* and *E. shimadai* both have internal scattered melanophores on the side, covered by the pectoral fin, running from the pectoral-fin axil to above the anus. Because of this similarity, it is appropriate to compare other characters between *E. shimadai* and *E. sigillata*. *Eviota shimadai* has a modal dorsal-fin count of VI+I, 8, whereas *E. sigillata* has a modal count of I,9 (Jewett and Lachner 1983 reported that only 7 of 31 specimens had a count of I,8). In life *E. sigillata* has silver spots under the eye that usually are lacking in *E. shimadai*.

Remarks.— We recognized that the specimens from Indonesia were undescribed. Later, comparing the underwater photographs from Indonesia with those in Senou et al. (2004), we noticed the great similarity to their *Eviota* sp. D (page 132). Noting that they recorded that species from the Ogasawara Islands, we reexamined a specimen from those islands previously identified as *E. sigillata* (BPBM 35322) by Randall et al. (1997) and found that it was the same species as the Indonesian specimens (Fig. 10). Kazuhiko Shimada first recognized this species as new, publishing photographs of it (Shimada and Yoshino 1993:5) and commented on its similarity to *E. sigillata*. *Eviota* sp. D of Senou et al. (2004) is also reported as *Eviota* sp. 4 ("Hanaguro-isohaze") in Nakabo (2002:1181). After reviewing an earlier version of this paper, R. Winterbottom realized that *Eviota* specimens he collected in Palau, and called species 5, appeared to be *E. shimadai* and kindly forwarded the specimens to us. These specimens now are included with the paratypes (Fig. 8).

Eviota rubrisparsa Greenfield and Randall, sp. nov.

Figures 11–16, 37D.

Material Examined.— Holotype: WAM P. 29017.003, 19.5 mm SL, male, Australia, Christmas Island, 0.5 km south of Smith Point, sand and dead coral, 10°26′S, 105°40′E, 20–28 m, rotenone, field number CIF-86-0, G.R. Allen and Campbell, 7 June 1986.

Paratypes: BPBM 39055, 12.3 mm SL, male, Papua New Guinea, New Britain, Lolobau Island, isolated rock on sand, 21 m, quinaldine, J.E. Randall, 3 August 2002; WAM P. 29017-004, 15.6mm SL, female, 18.3 mm SL male, taken with holotype; CAS 228615, 17.0 mm SL, male, taken with holotype.

Diagnosis.— The following combination of characters distinguishes *E. rubrisparsa* from congeners: dorsal/anal fin-ray formula 9/8; 16–19 pectoral-fin rays (mean 18), 5–6 lower rays branched; cephalic sensory-pore system pattern I (complete); 5th segmented pelvic-fin ray 11.5–22% of 4th; branches on fourth pelvic-fin ray 5–7, 3 segments between branches; genital

papilla non-fimbriate; dorsal fin filamentous (to 36.9% SL); no obvious large dark marks on body; anal fin and lower half of caudal fin dark; scattered melanophores behind eyes on nape; body covered with small red dots in life, which disappear in ETOH.

Description.— Dorsal-fin rays VI+1,9; anal-fin rays I,8; pectoral-fin rays 19 (16–19, 18), rays 14–18 branched (11 through 18); pelvic-fin rays I,5, 5th ray 13.3 % of 4th (11.5–22%); 7 branches on 4th ray (5–7), 3 segments between branches; branched caudal-fin rays 13 (10–13); segmented caudal-fin rays 17 (16–17); lateral scale rows 25; transverse scale rows 7; breast scaleless; first dorsal fin of holotype filamentous (36.9% SL, reaching to 7th ray of second dorsal fin); pelvic fins reaching past genital papilla; cephalic sensory-pore system pattern I (complete); male genital papilla non-fimbriate.

Measurements: Standard length 12.3–19.5 mm; head length 29.0 (23.8–29.8, 28.3); origin of first dorsal fin 33.6 (33.6–36.1, 35.1); origin of second dorsal fin 53.3 (51.9–54.7, 53.9); origin of anal fin 60.0 (59.6–63.6, 61.0); caudal-peduncle length 26.1 (22.6–27.5, 25.9); caudal-peduncle depth 11.0 (11.0–12.9, 12.0); body depth 17.9 (17.7–21.1, 18.6); eye diameter 8.7 (8.7–10.2, 10.1); snout length 4.6 (4.4–4.6, 4.5); pectoral-fin length 34.4 (28.2–34.4, 31.0); pelvic-fin length 34.6 (25.4–35.9, 31.6).

Color in preservative: Background color of body, head, and fins pale yellowish with no bold markings. Scattered melanophores behind eye and on nape, snout, jaws, and sometimes under chin, with a line of melanophores extending posteriorly from eye over preopercle and opercle. Anal and lower half of caudal fin dusky. Scattered melanophores on upper half of caudal, distal portion of first and second dorsal, pectoral, and pelvic fins. Iris of eye black, pupil clear.

Color in life: Head and body translucent, with internal silver lines along vertebral column and silver in abdomen visible. Body and caudal fin covered with a sprinkling of small red dots, with eight larger red-dashed lines along midline, the anteriormost behind the eye. A second red line on head behind eye, just above red line at midline. Upper and lower jaws red, snout silver. A red area extending from lower portion of posterior of eye across preoperculum and operculum. Pectoral fin base with a silver bar across its center, with red above and below. Iris of eye gold with distinct black markings on dorsal surface, pupil black, surrounded by a bright gold ring on the iris.

Although the second author was only able to photograph and collect a single individual of *E. rubrisparsa* (Fig. 11), he has taken photographs of this species at four other locations: Alor, Indonesia (Fig. 12); Kimbe Bay, New Britain, Papua New Guinea (Fig. 13); Maumere at Flores, Indonesia (Fig. 14); and D'Entrecasteaux Islands, Papua New Guinea (Fig. 15). G.R. Allen provided additional specimens of *E. rubrisparsa* from Christmas Island (Indian Ocean) and a photograph from West Papua (Fig.16). He also has photographed *E. rubrisparsa* at the Solomon Islands.

Etymology.— The specific epithet is an adjective combining the Latin *rubrum* (red) and *sparsus* (sprinkled), referring to the main live color pattern of red dots.

Comparisons.— *Eviota rubrisparsa* has a complete cephalic sensory-canal pore configuration, belonging to Group I of Lachner and Karnella (1980). With the addition of *E. rubrisparsa,* the total in this group is now 25. *Eviota rubrisparsa* has a dorsal/anal formula of 9/8, whereas the following species in Group I have different formulas: 8/7 – *E. pardalota* Lachner and Karnella 1978; 8/8 – *E. distigma* Jordan and Seale 1906, *E. herrei* Jordan and Seale 1906, *E. monostigma* Fourmanoir 1971, *E. nebulosa* Smith 1958, *E. nigripinna* Lachner and Karnella 1980, *E. pseudostigma* Lachner and Karnella 1980, and *E. randalli* Greenfield 2009; 10/8–10/9 – *E. abax* (Jordan and Snyder 1901), *E. natalis* Allen 2007 (also 9/8), and *E. masudai* Matsuura and Senou 2006. Of those Group I species with a formula of 9/8, *E. melasma* Lachner and Karnella 1980 and *E. smaragdus* Jordan and Seale 1906 both have a single, prominent dark occipital spot that is lacking in *E rubrisparsa*. *Eviota rubrisparsa* has a filamentous dorsal fin, whereas *E. disrupta* Karnel-

FIGURE 1. *Eviota toshiyuki*, holotype, OMNH-P 35366, 18.0 mm SL female, Ogasawara Islands. Photograph by T. Suzuki.
FIGURE 2. *Eviota toshiyuki*, paratype, BPBM 35204, 17.8 mm SL, Ogasawara Islands. Photograph by J.E. Randall.
FIGURE 3. *Eviota epiphanes*, Hawaii, Oahu, estimated total length 17 mm. Photograph by J.E. Randall.
FIGURE 4. *Eviota zonura*, Ataoru, Indonesia, estimated total length 17 mm. Photograph by J.E. Randall.
FIGURE 5. *Eviota winterbottomi*, holotype, ROM 73100, 14.7 mm SL, Vietnam. Photograph by R. Winterbottom.
FIGURE 6. *Eviota winterbottomi*, BPBM 38789, 15.1 mm SL, Indonesia, Komodo. Photograph by J.E. Randall.
FIGURE 7. *Eviota shimadai*, holotype, NSMT-P 94898, 14.5 mm SL, male, Japan, Ryukyu Islands. Photograph by T. Suzuki.
FIGURE 8. *Eviota shimadai*, paratype, ROM 84590, 10.5 mm SL, male, Palau. Photograph by R. Winterbottom.
FIGURE 9. *Eviota shimadai*, paratype, OMNH-P 34244, 12.3 mm SL, female, Japan, Ryukyu Islands. Photograph by T. Suzuki.
FIGURE 10. *Eviota shimadai*, paratype, BPBM 35322, 15.1 mm SL, female, Ogasawara Islands. Photograph by J.E. Randall.
FIGURE 11. *Eviota rubrisparsa*, paratype, BPBM 39055, 12.3 mm SL, male, Papua New Guinea, New Britain, Lolobau Island. Photograph by J.E. Randall.
FIGURE 12. *Eviota rubrisparsa*, Indonesia, Alor, estimated total length 20 mm. Photograph by J.E. Randall.

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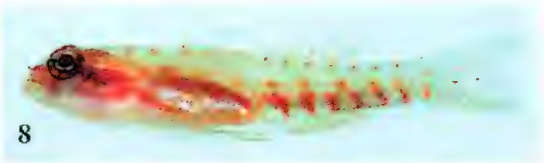
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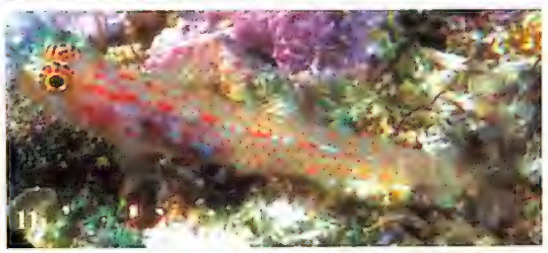
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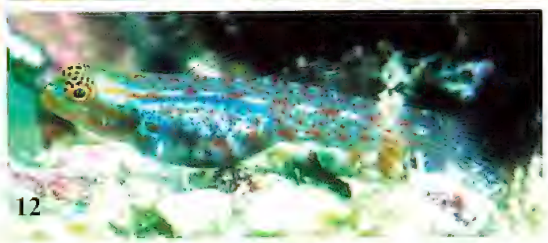
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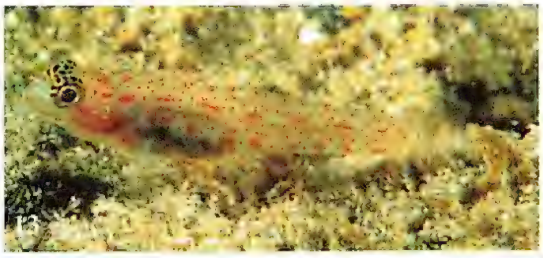
FIGURE 13. *Eviota rubrisparsa*, Papua New Guinea, New Britain, Kimbe Bay, estimated total length 25mm. Photograph by J.E. Randall.
FIGURE 14. *Eviota rubrisparsa*, Indonesia, Flores at Maumere, estimated total length 22 mm. Photograph by J.E. Randall.
FIGURE 15. *Eviota rubrisparsa*, Papua New Guinea, D'Entrecasteaux Islands, estimated total length 18 mm. Photograph by J.E. Randall.
FIGURE 16. *Eviota rubrisparsa*, Cenderawasih Bay, West Papua. Photograph by G.R. Allen.
FIGURE 17. *Eviota guttata*, Red Sea, 18.9 mm SL, Fig. 5B from Herler and Hilgers (2005). Courtesy of J. Herler.
FIGURE 18. *Eviota guttata*, Red Sea, 18.9 mm SL, Fig. 5A from Herler and Hilgers (2005). Courtesy of J. Herler.
FIGURE 19. *Eviota guttata*, Red Sea. Courtesy of S. Bogorodsky.
FIGURE 20. *Eviota guttata*, Red Sea. Photograph by J.E. Randall.
FIGURE 21. *Eviota guttata*, Musandam, Oman. Photograph by J.E. Randall.
FIGURE 22. *Eviota guttata*, Maldives. Photograph by J.E. Randall.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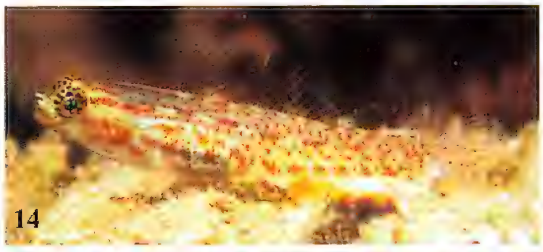
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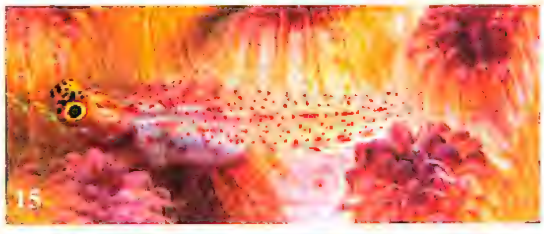
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FIGURE 23. *Eviota guttata*, Indonesia. Photograph by J.E. Randall.
FIGURE 24. *Eviota guttata*, Bali. Photograph by J.E. Randall.
FIGURE 25. *Eviota guttata*, New Britain. Photograph by J.E. Randall.
FIGURE 26. *Eviota guttata*, Vietnam, ROM 73069, 17.7 mm, SL. Photograph by R. Winterbottom.
FIGURE 27. *Eviota guttata*, Great Barrier Reef, Australia. Photograph by J.E. Randall.
FIGURE 28. *Eviota guttata*, Ogasawara Islands. Photograph by J.E. Randall.
FIGURE 29. *Eviota guttata*, Fiji. Photograph by J.E. Randall.
FIGURE 30. *Eviota guttata*, American Samoa. Photograph by J.E. Randall.
FIGURE 31. *Eviota albolineata*, Tahiti, 19 mm SL Photograph by J.E. Randall.
FIGURE 32. *Eviota albolineata*, Moorea, ROM 60765, 19.6 mm SL. Photograph by R. Winterbottom
FIGURE 33. *Eviota albolineata*, Mangareva, 25 mm SL. Photograph by J.E. Randall.
FIGURE 34. *Eviota albolineata*, Kiritimati. Photograph by J.E. Randall

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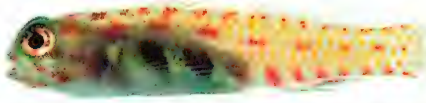
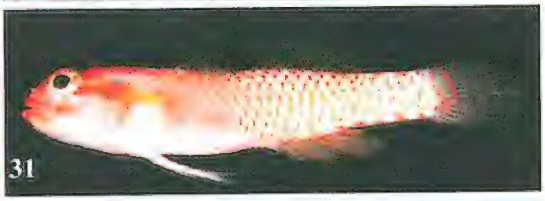




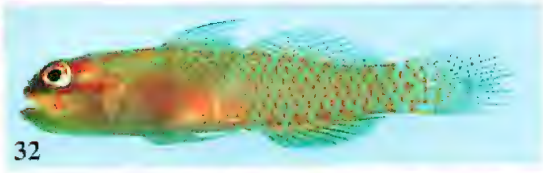
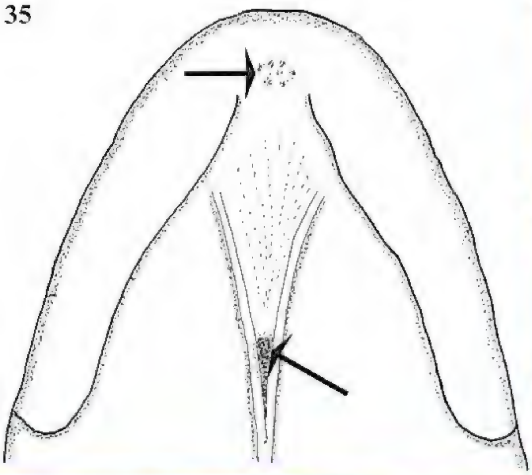


FIGURE 35. *Eviota guttata*, Fiji, CAS 219808, 16.2 mm SL. Arrows mark distinctive markings on chin and throat. Drawing by D.W. Greenfield.
FIGURE 36. *Eviota albolineata*, Moorea, ROM 60905, 18.6 mm SL. Pectoral-fin base pigmentation.
FIGURE 37A. *Eviota toshiyuki*, holotype, OMNH-P 35366, 18.0 mm SL female, Ogasawara Islands. Preserved.
FIGURE 37B. *Eviota winterbottomi*, holotype, ROM 73100, 14.7 mm SL. Vietnam. Preserved.
FIGURE 37C. *Eviota shimadai*, holotype, NSMT-P 94898, 14.5 mm SL, male, Japan, Ryukyu Islands. Preserved.
FIGURE 37D. *Eviota rubrisparsa*, holotype, WAM P. 29017.003, 19.5 mm SL, Christmas Island. Preserved.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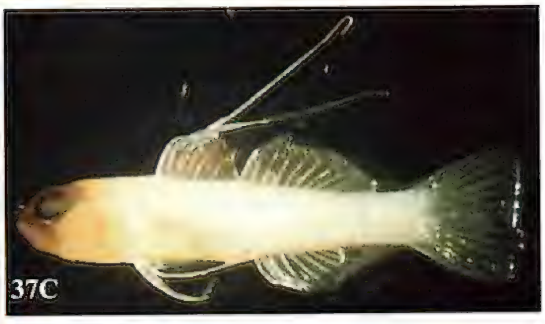
37C

37D

la and Lachner 1981, *E. epiphanes* Jenkins 1903, *E. fasciola* Karnella and Lachner 1981, *E. irrasa* Karnella and Lachner 1981 and *E. readerae* Gill and Jewett 2004 are not filamentous. The remaining species do have a filamentous dorsal fin: *E. albolineata* Jewett and Lachner 1983 (but uncommon according to Jewett and Lachner 1983), *E. guttata* Lachner and Karnella 1978, *E. inutilis* Whitley 1943, *E. korechika*, Shibukawa and Suzuki 2005, and *E. natalis* Allen 2007. *Eviota inutilis* has a small dark spot lateral to the pelvic-fin base and a large diffuse occipital spot above the opercle that are lacking in *E. rubrisparsa*. *Eviota korechika* has two dark vertically aligned spots on the pectoral-fin base that are absent in *E. rubrisparsa*. *Eviota rubrisparsa* is illustrated as *E. albolineata* on page 215 in Allen et al. 2007.

Comparison of *Eviota guttata* and *E. albolineata*

Early descriptions of species of the gobiid fish genus *Eviota* lacked information on the life color. Such was the case when Lachner and Karnella (1978) described *Eviota guttata* from the Red Sea and the Gulf of Oman. Jewett and Lachner (1983) then described *Eviota albolineata* without photographs of live or fresh specimens from type material collected in the Society Islands. They examined numerous nontype specimens from the Tuamotu Archipelago to Mozambique. They wrote, "This species is a complex of two color forms, one highly pigmented, represented in part by the type material from the Society Islands and Tuamotu Archipelago (eastern Oceania population) and a pallid form that is more widespread, occurring more to the west in Oceania, the Indo-Australian Archipelago, the Great Barrier Reef, and the Indian Ocean (western Oceania-Indian Ocean population)." (Jewett and Lachner 1983:785). They reported three notes on the fresh coloration from other authors (one as "solid brilliant green") (Jewett and Lachner 1983:787), but these are not diagnostic for the species.

Because Jewett and Lachner (1983) included nontype material from the western Pacific to the Indian Ocean in their description of *Eviota albolineata*, and because *E. guttata* was thought to occur only in the Red Sea and Oman, other authors have identified specimens matching their description from the western Pacific as *E. albolineata*. Sunobe and Shimada (1989) published what they believed to be the first record of *E. albolineata* from Japan with underwater and fresh specimen photographs in color. Hayashi and Shiratori (2003: 48) and Senou et al. (2004: 129) followed with additional live color photographs from Japan; however, Myers (1999:253, pl. 159, I and K) included both species in his book on the fishes of Micronesia (neither are *E. albolineata*).

Herler and Hilgers (2005) published excellent color photographs of both live and fresh specimens of *Eviota guttata* from the Red Sea (reproduced as our Figs.17 and 18), Sergey Bogorodsky provided one of his underwater photographs from the Red Sea (Fig. 19), and we present new figures from the Red Sea (Fig. 20), Oman (Fig. 21) and the Maldives (Fig. 22). To show variation in color over geographic areas we include photographs of similar fish from Indonesia (Figs. 23 and 24), New Britain (Fig. 25), Vietnam (Fig. 26), Great Barrier Reef (Fig. 27), Ogasawara Islands (Fig. 28), Fiji (Fig. 29), and American Samoa (Fig. 30, easternmost record).

We provide here photographs of fresh material from the eastern populations of *E. albolineata* from Tahiti (Fig. 31), and Moorea (Fig. 32) in the Society Islands, Mangareva in the Tuamotu Archipelago (Fig. 33), and Kiritimati in the Line Islands (Fig. 34). A comparison with photographs from the Red Sea, Indian Ocean, and the western Pacific reveals distinct differences.

Eviota albolineata is presently known from the Society Islands, Tuamotus, and Line Islands. It is replaced in the more western part of the Pacific and into the Indian Ocean by *E. guttata*. In their description of *E. albolineata*, Jewett and Lachner (1983) discussed the difficulty they had in separating *E. albolineata* from *E. guttata*. They wrote, "Yet, we regard our interpretation of these

species as tentative..." (Jewett and Lachner 1983:787–788). Their hesitation is understandable, considering that they included specimens of *E. guttata* in their material of *E. albolineata*.

Species of *Eviota* have been separated in the literature by the following morphological characters: Cephalic sensory-pore patterns, dorsal/anal fin-ray formulas, presence or absence of a filamentous dorsal fin; number of pectoral-fin rays and their branching; relative development of fifth pelvic-fin ray; number of branches on fourth pelvic-fin ray and number of segments between branches; and structure of the genital papilla. These characters are used to place species into groups, but then one must often use color patterns to separate species within those groups, and old museum specimens may not reliably show those characters. *Eviota guttata* and *E. albolineata* are an example because *E. guttata* and *E. albolineata* do not differ in counts or measurements. There are, however, color differences in preserved material of these two species that support the differences seen in live and fresh specimens. *Eviota guttata* has a dark spot on the ventral side of the head on the isthmus, about in line with the posterior portion of the maxilla. In addition, there are a few scattered melanophores on the underside of the lower jaw near the tip (Fig. 35). The intensity of this dark pigmentation varies, from a few melanophores to a very dark area. These dark spots are absent in *E. albolineata*. *Eviota albolineata* has a scattering of melanophores obliquely across the pectoral-fin base that is concentrated in the center (Fig. 36). Although *E. guttata* may have a few scattered melanophores on the pectoral-fin base, they are not concentrated into a band. *Eviota albolineata* also has two distinct bands of melanophores extending posteriorly from the eye. The upper band is narrow, extending from the eye to above the pectoral-fin base. The lower band is broader and extends across the cheek onto the opercle. These bands correspond to the red bands extending back from the eye in fresh material.

Although these pigment patterns are obvious in preserved material that has been in collections for relatively few years, the dark pigment often fades in specimens that are much older. Many of the CAS specimens collected during the Vanderbilt expeditions (1954–1956) only have one or two melanophores remaining at the tip of the chin or gular area, or show no pigmentation at all; however, CAS 48479 from Saipan, collected in 1956, still retains strong gular pigmentation in all four specimens. Added to this problem is variation in the extent of pigmentation in different specimens. Within a single lot collected at the same time, some specimens will have strong pigmentation, others just a few melanophores. Obviously the live or fresh coloration of the two species is a much better character to separate them.

Eviota rubrisparsa lacks the dark spots on the gular area present in *E. guttata*, and the pectoral-fin band that is present in *E. albolineata*. In addition, the live and fresh coloration of *E. rubrisparsa* differs greatly from either species. Allen et al. (2007) illustrate both *E. rubrisparsa* (as *E. albolineata*) and *E. natalis* (a species similar to *E. guttata* and *E. albolineata*), showing the great difference in live coloration between the two species.

Discussion

Since Lachner and Karnella (1978, 1980), Karnella and Lachner (1981), and Jewett and Lachner (1983) first recognized different cephalic sensory-pore patterns among *Eviota* species, these patterns have played an important role in the systematics of this genus. Descriptions of new species often compare those species with others included in the specific pore-pattern group (Group I, II, etc.). Although the monophyly of these groups has never been tested, there has been a tendency to treat these groups as natural. In this paper we have two examples of species that are very similar to other described species, but because of the loss of a single pore are placed in another pore-pattern group. *Eviota shimadai* looks very similar to *E. sigillata*, but it lacks the PITO and IT pores

and thus belongs to Group IV, whereas *E. sigillata* has the PITO pore and thus belongs to Group III. *Eviota toshiyuki* looks very similar to *E. zonura*, but it has a complete cephalic sensory-canal pore configuration (Group I), whereas *E. zonura* lacks the IT pore and thus belongs to Group II. A phylogenetic and ontogenetic study of representatives of the pore pattern groups should prove to be most informative regarding this issue.

Comparative material examined.— *Eviota albolineata*: CAS 48471(4), paratypes, Tahiti; CAS 48469(6), Moorea [illustrated in Jewett and Lachner (1983)]; ROM 60765(2), Moorea; ROM 60905(23), Moorea; BPBM 9418(4), Tahiti; BPBM 11288(1), Moorea; CAS 48526(2), Kiribati. *Eviota epiphanes*: CAS-227277(278), Hawaii; CAS 43820(2), Kiribati. *Eviota guttata*: CAS 77357(7), Maldives; BPBM 33283(12), Saudi Arabia; WAM P. 28577.001 (6), Chagos Archipelago; CAS 219808(27), CAS 48524(3), American Samoa; CAS 48464(1), CAS 48468(1), Guam; CAS 48479(4), Saipan; CAS 48163(1), CAS 48465(1), Palau; CAS 48462(5), CAS 48463(15), CAS 48466(7), CAS 48475(10), Caroline Islands; CAS 219808(27), Fiji; WAM P. 27824.039(2), WAM P. 30619.008(9), WAM P. 30621.021(2), WAM P. 30630.019(1), WAM P. 30633.012(5), WAM P. 30635.009(21), WAM P. 30636(2), WAM P. 32984.022 (1), Papua New Guinea; WAM P. 30804.003(1), Indonesia; BPBM 35306(2), Ogasawara Islands. *Eviota sigillata*: CAS 47862(2), Pohnpei Island; CAS 47864(3), Palau; BPBM 37669(2), Indonesia; BPBM 37738(5), Palau. *Eviota zonura*: CAS 219811(23), Fiji.

Acknowledgments

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Literature Cited

Akihito, K. Sakamoto, A. Iwata, and Y. Ikeda. 1993. Cephalic sensory organs of the gobioid fishes. Pages 1088–1116 *in* T. Nakabo, ed., *Fishes of Japan with Pictorial Keys to the Species*. Tokai University Press, Tokyo, Japan. 1474 pp. (In Japanese.)

Allen, G.R., R.C. Steene, and M. Orchard. 2007. *Fishes of Christmas Island* (*Second Edition*). Christmas Island Natural History Association, Christmas Island. 284 pp.

Greenfield, D.W. 2009. *Eviota randalli*, a new gobiid fish from Oceania. *Proceedings of the California Academy of Sciences*, ser. 4, 60(19):671–675.

Greenfield, D.W., and J.E. Randall. 2008. *Eviota tigrina*, a new goby from Tonga (Teleostei: Gobiidae). *Proceedings of the California Academy of Sciences*, ser. 4, 59(11):497–501.

Hayashi, M., and T. Shiratori. 2003. *Gobies of Japanese Waters*. TBS Buritanica, Tokyo, Japan. 223 pp.

Herler, J., and H. Hilgers. 2005. A synopsis of coral and coral-rock associated gobies (Pisces: Gobiidae) from the Gulf of Aqaba, northern Red Sea. *Aqua, Journal of Ichthyology and Aquatic Biology* 10(3): 103–132.

Jewett, S.L., and E.A. Lachner. 1983. Seven new species of the Indo-Pacific genus *Eviota* (Pisces: Gobiidae). *Proceedings of the Biological Society of Washington* 96(4):780–806.

KARNELLA, S.J., AND E.A. LACHNER. 1981. Three new species of the *Eviota epiphanes* group having vertical trunk bars (Pisces: Gobiidae). *Proceedings of the Biological Society of Washington* 94(1):264–275.

LACHNER, E.A., AND S.J. KARNELLA. 1978. Fishes of the genus *Eviota* of the Red Sea with descriptions of three new species (Teleostei: Gobiidae). *Smithsonian Contributions to Zoology* No. 286:1–23.

LACHNER, E.A., AND S.J. KARNELLA. 1980. Fishes of the Indo-Pacific genus *Eviota* with descriptions of eight new species (Teleostei:Gobiidae). *Smithsonian Contributions to Zoology* No. 315:1–127.

LEVITON, A.E., R.H. GIBBS JR., E. HEAL, AND E.E. DAWSON. 1985. Standards in herpetology and ichthyology. Part 1, Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia* 1985(3):802–832.

MASUDA, H., K. AMAOKA, C. ARAGA, T. UYENO, AND T. YOSHINO (EDS.). 1984. *The Fishes of the Japanese Archipelago*. English text. Tokai University Press, Tokyo, Japan. 437 pp., 370 pls.

MASUDA, H., AND Y. KOBAYASHI. 1994. *Grand Atlas of Fish Life Modes Color Variation in Japanese Fish*. Tokai University Press, Tokyo, Japan. 465 pp.

MATSUURA, K. AND H. SENOU. 2006. *Eviota masudai*, a new gobiid fish (Teleostei: Perciformes) from Japan. *Memoirs of the National Science Museum, Tokyo* 4:341–349.

MYERS, R.F. 1999. *Micronesian Reef Fishes: A Comprehensive Guide to the Coral Reef Fishes of Micronesia, 3rd revised and expanded edition*. Coral Graphics, Guam. 330 pp.

NAKABO, T (ED.). 2002. *Fishes of Japan with Pictorial Keys to the Species*. English edition. Tokai University Press, Tokyo, Japan. 2 vols. 1749 pp.

RANDALL, J.E., H. IDA, K. KATO, R.L. PYLE, AND J.L. EARLE. 1997. Annotated checklist of the inshore fishes of the Ogasawara Islands. *Natural Science Museum Monographs* No. 11. 74 pp.

SARUWATARI, T., J.A. LOPEZ, AND T.W. PIETSCH. 1997. Cyanine blue: a versatile and harmless stain for specimen observations. *Copeia* 1997(4):840–841.

SENOU, H, J.T.SUZUKI, K. SHIBUKAWA, AND K. YANO. 2004. *A Photographic Guide to the Gobioid Fishes of Japan*. Heibonsha Co., Japan. 536 pp.

SHIBUKAWA, K. AND T. SUZUKI. 2005. Two new species of the gobiid fish genus *Eviota* (Teleostei, Perciformes, Gobioidei) from the Western Pacific. *Bulletin of the National Science Museum, Tokyo*, Series A, 31(2):65–76.

SHIMADA, K.,AND T. YOSHINO. 1993. First records of several gobiids genera *Eviota, Sueviota, Trimma* and *Trimmatom* from Japan (III). *I.O.P. Diving News* 4 (2):2–6.

SUNOBE, T., AND K. SHIMADA. 1989. First record of the gobiid fish, *Eviota albolineata*, from Japan. *Japanese Journal of Ichthyology* 35(4):479–481.

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Catalog of Guatemalan Acanthaceae: Taxonomy, Ecology, and Conservation

Thomas F. Daniel

Department of Botany, California Academy of Sciences, 55 Music Concourse Drive, Golden Gate Park, San Francisco, CA 94118 U.S.A.; Email: tdaniel@calacademy.org

This revision of Acanthaceae in Guatemala recognizes 25 genera with 124 species as native to that nation. Sixteen species (13% of native species) are endemic to Guatemala. Four additional genera and seven species have escaped from cultivation and become naturalized in Guatemala. More than 60 changes to the treatment of the family in the *Flora of Guatemala*, published in 1974, reflect taxonomic renovations, recently described species, and new distribution records. Here, a new species of *Justicia* (*J. velizii*) is described from Izabal and Petén, *J. macrantha* var. *piliformis* is elevated to specific rank as *J. williamsii*, and two new combinations in *Stenostephanus* are proposed (*S. azureus* and *S. ruberrimus*). This account includes original descriptions of 25 species (including most endemics); information on flowering and fruiting periods and distributions within Guatemala; conservation notes for rare and endemic species; and taxonomic, nomenclatural, and/or morphological notes as appropriate. New typifications are discussed and/or proposed for *Mendoncia lindavii* and *Ruellia stemonacanthoides*.

La presente revisión de Acanthaceae en Guatemala reconoce 25 géneros con 124 especies como nativas en esa nación. Dieciséis especies (13% de las especies nativas) son endémicas a Guatemala. Cuatro géneros adicionales y siete especies se han escapado de cultivo y se han naturalizado en el país. Más de 60 cambios al tratamiento de la familia en la *Flora of Guatemala*, publicada en 1974, reflejan renovaciones taxonómicas, especies recientemente descritas y registros nuevos de distribución. Aquí, una especie nueva de *Justicia* (*J. velizii*) se describe de Izabal y Petén, se eleva *J. macrantha* var. *piliformis* al nivel de especie como *J. williamsii* y se proponen dos combinaciones nuevas en *Stenostephanus* (*S. azureus* y *S. ruberrimus*). Este trabajo incluye descripciones de 25 especies (incluyendo la mayoría de especies endémicas); información sobre épocas de floración y fructificación y distribuciones dentro de Guatemala; notas sobre la conservación de las especies raras y endémicas; y notas taxonómicas, nomenclaturales y/o morfológicas cuando es pertinente. Se discuten y/o se proponen tipificaciones nuevas para *Mendoncia lindavii* y *Ruellia stemonacanthoides*.

Guatemala occupies a region particularly rich in Acanthaceae but inadequately collected in recent decades. The following catalog of Guatemalan Acanthaceae updates the account of the family in the *Flora of Guatemala* (Gibson 1974). With the completion of this flora in 1977 and political unrest in the country during the last quarter of the twentieth century, relatively little international botanical activity was undertaken in Guatemala for several decades. However, activities of Guatemalan botanists and collectors since 1980 have resulted in the growth or establishment of at least four significant herbaria in Cd. Guatemala: AGUAT, BIGU, USCG, and UVAL. These important collections contain many unique taxonomic and geographic records. Studies in these and other herbaria, combined with numerous monographic (e.g., Daniel 1983, 1986, 1988, 1990a, 1991a, 1991b, 1995c, 1999b) and floristic (e.g., Daniel 1995b, 1997a, 2001, 2005) studies of Acanthaceae that include plants in Mexico and Central America, have resulted in the reevaluation of numerous species that either occur in or are endemic to Guatemala. This account has the following goals: 1) to study Guatemalan Acanthaceae anew and in the context of recent taxonomic and phylogenetic work on the family; 2) to provide an updated/revised listing of Acanthaceae that are documented from Guatemala; 3) to provide data on the distribution and ecological preferences of each taxon within Guatemala by indicating the departments from which collections of each species have been taken and by listing habitats, elevations, and flowering times for each species based solely on Guatemalan collections; 4) to describe/document taxonomic novelties and new distribution records; 5) to provide updated descriptive, nomenclatural, and conservation information for all Guatemalan acanths that are either endemic to the country or have not been treated recently (e.g., in Daniel 1995b, 2005; Durkee 2001); 6) to indicate one or more recent sources for descriptions of all other Acanthaceae occurring in Guatemala; and 7) to provide an aid for the collection and distribution of specimens of Guatemalan Acanthaceae so that they are better represented in herbaria. While Guatemalan Acanthaceae will be treated in a forthcoming volume of the *Flora Mesoamericana*, that account will not focus on plants in Guatemala, nor will it include many of the taxonomic, nomenclatural, geographic, or conservation details noted here.

With an area of about 108,890 square kilometers, Guatemala (Fig. 1) is the third largest among the seven Central American nations. Estimates of the number of vascular plants there vary from about 8,000

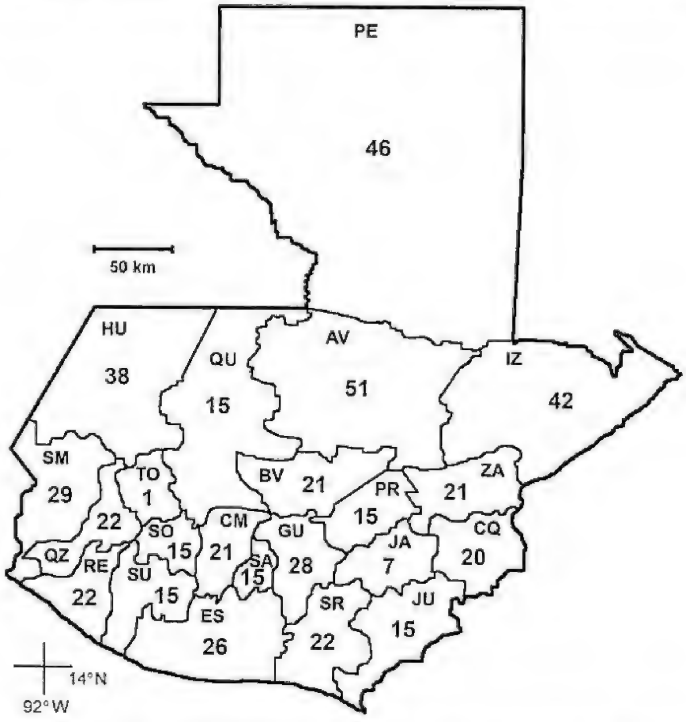


FIGURE 1. Map of Guatemala showing departments and numbers of native species of Acanthaceae in each. AV=Alta Verapaz, BV=Baja Verapaz, CM=Chimaltenango, CQ=Chiquimula, ES=Escuintla, GU=Guatemala, HU=Huehuetenango, IZ=Izabal, JA=Jalapa, JU=Jutiapa, PE=Petén, PR=El Progreso, QZ=Quezaltenango, QU=Quiché, RE=Retalhuleu, SA=Sacatepéquez, SM=San Marcos, SR=Santa Rosa, SO=Sololá, SU=Suchitepéquez, TO=Totonicapán, ZA=Zacapa.

(Davis et al. 1986) to 8,691 (Goombridge and Jenkins 2002). The number of species endemic to Guatemala is often given as 1,171 (e.g., Davis et al. 1986; Goombridge and Jenkins 2002). A total of 8,436 native vascular plants was calculated from data provided by Véliz (2008). He noted only 538 species (apparently also including nonvascular plants) as endemic to Guatemala. Because this number of endemics appears to be underestimated (e.g., the number of endemic Acanthaceae is listed as zero, and his table of the number of endemics for the 20 largest families of vascular plants totals more than 600), I suspect that the number of endemics is closer to 1,000.

Acanthaceae are among the 20 largest families of flowering plants in Guatemala (Véliz 2008). Gibson (1974) recognized 123 species (23 endemic to Guatemala) in 33 genera (one, *Megalostoma*, endemic to Guatemala) as native to the country. She also treated additional species that either were known only from Belize (e.g., *Louteridium chartaceum* Leonard) or that might be expected to occur in Guatemala (e.g., *Stenostephanus silvaticus* (Nees) T.F. Daniel, as *Habracanthus silvaticus* Nees). Newly discovered taxa, reevaluated taxa, new distribution records, and numerous taxonomic and nomenclatural changes resulting from studies of Acanthaceae in Mexico and Central America during the past 30 years have resulted in more than 60 changes to Gibson's account. For example, several genera recognized by Gibson (1974) are now treated as congeneric with other genera (*Teliostachya* and *Lophostachys* = *Lepidagathis*; *Buceragenia* = *Pseuderanthemum*; *Chaetothylax*, *Neohallia*, *Megalostoma*, and *Siphonoglossa* = *Justicia*; *Trybliocalyx* = *Chileranthemum*; *Hansteinia* and *Habracanthus* = *Stenostephanus*; *Averia* = *Tetramerium*; *Blechum* = *Ruellia*).

Methods

This revision is based on focused field studies in Guatemala during 2009 and 2010, and studies of all herbarium specimens of Guatemalan Acanthaceae at the following herbaria: AGUAT, BIGU, CAS, DS, DUKE, F, MO, MICH, TEX/LL, UC, US, USCG, and UVAL. Additional collections from Guatemala were examined at A, BM, G, GH, K, L, M, NY, P, PH, POM, RSA, S, and UPS. Morphological data for keys and descriptions in the taxonomic catalog below are derived from the herbarium collections. Where a recent description is available, and concurs with Guatemalan plants, a reference to it is provided. When a recent description is either unavailable or when Guatemalan plants depart significantly from a recent description, an original description is provided. New and comprehensive descriptions are provided for most of the species endemic to Guatemala. In the following species accounts, the description (or reference to a recent description) is followed by the known flowering and fruiting periods of Guatemalan representatives of each species based on the presence of flowers or fruits on herbarium specimens. These phenological data are followed by ecological information based on notes from labels of Guatemalan collections and personal observations. Sadly, comprehensive and/or precise ecological data (especially biotic community or communities of occurrence) seldom are found on collection labels of Guatemalan Acanthaceae. In order to provide some indications about the communities and habitats in which Guatemala Acanthaceae grow, those data available are listed here under "habitats," along with the known elevational ranges. These data (except as noted) pertain only to the species as they occur in Guatemala. The communities (where known) are listed first in a sequence from wetter to drier; these are followed by the local habitats and elevational range. Local names and uses (if any), usually based on collection notes, are followed by a listing/documentation of collections by department in Guatemala. Usually only a single collection per department is listed and specific localities are provided only for some of the rare taxa. All types derived from Guatemalan collections are noted. In several instances, Gibson (1974) indicated occurrences in departments from which species were not seen during my studies. These potential discrepancies are noted in the discussions.

In some instances, she might have seen materials that I did not, but most such purported occurrences are based either on misidentifications or different taxonomic interpretations. Discussions also include information on morphological variation, taxonomic interpretations, nomenclature, distribution, and conservation status. Photographs of flowers representing numerous Guatemalan Acanthaceae are provided to highlight the morphological diversity of floral form in the family and as an aid to identification. Scanning electron micrographs of pollen, where available, are shown for all species native to Guatemala, unless images of them have been published elsewhere. Acanthaceae are the most eurypalynous of all flowering plant families, and pollen grains are often diagnostic at generic or specific ranks. A special effort was made to image pollen of Guatemalan endemics. The only endemic species of Guatemalan Acanthaceae for which pollen remains undocumented is *Justicia steyermarkii*. Images of pollen for native Guatemalan Acanthaceae not provided herein can be found among the references cited (e.g., Gibson 1972; Daniel 1998). Several collections of Guatemalan Acanthaceae that cannot be identified with certainty are discussed under species to which they appear most similar.

Summary of Results

Taxonomic richness, diversity, and endemism. Recent herbarium and field studies document the native or naturalized occurrences of 131 species in 29 genera in the country (Table 1). Of these, 25 genera with 124 species are native to Guatemala. Although no genera of Acanthaceae are restricted in distribution to Guatemala, 16 species (13% of the native species) of the family are endemic there: *Dicliptera debilis*, *D. guttata*, *Justicia gibsoniae*, *J. neomontana*, *J. pedicellata*, *J. sangilensis*, *J. silvicola*, *J. steyermarkii*, *J. velizii*, *J. viridescens*, *J. williamsii*, *Odontonema steyermarkii*, *Poikilacanthus pansamalanus*, *P. skutchii*, *Stenostephanus azureus*, and *S. ruberrimus*. These numbers are somewhat higher than previously reported by Daniel (2005) because new taxa are still being discovered in Guatemala (e.g., Daniel 2007; Daniel and Véliz 2009), especially in species-rich regions that are not well collected (e.g., Cerro San Gil; *cf.* MacVean and Davidse 2007). Comparison of these numbers with those of other regions of Mesoamerica (Daniel 2005) reveals that 1) Guatemala has more species of native Acanthaceae than any other Central American nation; 2) it has fewer endemic species than either Costa Rica (38 species; 31% of the native species) or Panama (21 species; 19% of the native species); 3) the numbers of native species and endemic species are virtually the same as encountered in the Mexican state of Chiapas to the north and west; and 4) Guatemala has about 1.7 and 2.1 times the number of native species of Acanthaceae known from the largest Central American nations, Honduras and Nicaragua, respectively. The relative richness of Acanthaceae in Guatemala is likely enhanced by: the relatively large size of the nation; the diversity of intact biotic communities, varying from wet (e.g., lowland and montane rain forests) to dry (e.g., thornscrub and tropical deciduous forests), that span elevations from sea level to more than 4200 m; proximity to nearby regions with considerable species richness (e.g., Chiapas) or with unusual/uncommon habitats (the Yucatán Peninsula of Mexico); a long and diverse geological history (cf. Steyermark 1950); and past collection activities that have documented much of the flora.

The status of Acanthaceae in Guatemala is perhaps better known than that in other Central American nations with similar numbers of species (e.g., Costa Rica, Panama) for several reasons. These include the existence of Gibson's (1974) excellent account of the family in Guatemala and recent surveys/studies of Acanthaceae in each of the political units adjacent to the country (i.e., Chiapas, Daniel 1995b; Belize, Daniel 1997a; El Salvador, Daniel 2001; Honduras, Daniel 2005; Tabasco, Cowan 1983; and Mexican states of the Yucatán Peninsula, Daniel unpublished). Based

on their occurrences in surrounding regions, where they occur in habitats that also are found in Guatemala, the following species could occur (or might have once occurred) in the country: *Avicennia bicolor* Standl., *Carlowrightia hintonii* T.F. Daniel, *C. myriantha* (Standl.) Standl., *Dyschoriste hirsutissima* (Nees) Kuntze, *Holographis websteri* T.F. Daniel, *Justicia ensiflora* (Standl.) D.N. Gibson, *J. laevilinguis* (Nees) Lindau, *J. tuxtlensis* T.F. Daniel, *Nelsonia canescens* (Lam.) Spreng., *Staurogyne agrestis* Leonard, *Stenandrium chameranthemoideum* Oerst., *Stenostephanus glaber* (Leonard) T.F. Daniel, *S. gracilis* (Oerst.) T.F. Daniel, *S. silvaticus* (Nees) T.F. Daniel, and *S. tacanensis* (Acosta & R. Fernández) T.F. Daniel.

This revision reflects and presents some significant taxonomic and distributional alterations. In addition to the generic renovations noted above, a new species of *Justicia* (*J. velizii*) is described from Izabal and Petén; *J. macrantha* var. *piliformis* is elevated to specific rank as *J. williamsii*; and two new combinations in *Stenostephanus* are proposed. New distributional records include: species reported for political departments for the first time, additions of native species to the country (either via collections or taxonomic renovations), and additions of three exotic species that have become naturalized in Guatemala.

TABLE 1. Summary of Guatemalan Acanthaceae

Genus	Number of Native Species	Number of Endemic Species	Number of Naturalized Species
Aphelandra	6	0	0
Asystasia	0	0	1
Avicennia	1	0	0
Barleria	1	0	0
Bravaisia	3	0	0
Carlowrightia	1	0	0
Chileranthemum	1	0	0
Dicliptera	9	2	0
Dyschoriste	3	0	0
Elytraria	2	0	0
Henrya	1	0	0
Hygrophila	1	0	0
Hypoestes	0	0	1
Justicia	39	9	0
Lepidagathis	2	0	0
Louteridium	2	0	0
Mendoncia	3	0	0
Odontonema	7	1	0
Poikilacanthus	3	2	0
Pseuderanthemum	4	0	0
Razisea	1	0	0
Ruellia	21	0	1
Sanchezia	0	0	1
Schaueria	1	0	0
Spathacanthus	2	0	0
Stenandrium	3	0	0
Stenostephanus	4	2	0
Tetramerium	3	0	0
Thunbergia	0	0	3
Totals	**124**	**16**	**7**

Guatemalan Acanthaceae represent most major lineages of the family. Appendix I shows the major phylogenetic clades of Acanthaceae and lists currently recognized genera of Guatemalan Acanthaceae in each. It is clear that Acanthoideae are most prevalent, and that within this subfamily, genera of Justicieae are best represented. *Justicia* includes some 700 species worldwide, and with 39 of them native in Guatemala, it is the largest genus of Acanthaceae in the country. Nine of these species (23%) are endemic to Guatemala. *Ruellia* (Ruellieae), the second largest genus of Guatemalan Acanthaceae, is represented by 21 native species, none of them endemic to the country.

Life forms of Guatemalan Acanthaceae vary from annual (e.g., *Dicliptera unguiculata*) to perennial (*Justicia ramulosa*) herbs to shrubs (e.g., *Odontonema steyermarkii*) to lianas (e.g., *Men-*

doncia guatemalensis) to trees (e.g., *Bravaisia integerrima*). Flowers of Guatemalan Acanthaceae are particularly variable (Figs. 2–4), undoubtedly reflecting the diversity of floral visitors and pollinators that are attracted to them. Floral rewards of Guatemalan Acanthaceae consist of sugary floral nectar and protein-rich pollen. Morphological diversity of pollen among Guatemalan Acanthaceae (Figs. 5–9) is also substantial, reflecting the phylogenetic and taxonomic array of species occurring in the region (Appendix I), and is comparable to that documented for Mexico (Daniel 1998). Animal visitors (including pollinators) to flowers of Acanthaceae that occur in Guatemala (based on literature reports, herbarium specimen notes, and personal observations) include: hummingbirds (e.g., *Justicia aurea*), flies (e.g., *Tetramerium nervosum*), bees (e.g., *Bravaisia integerrima*), butterflies (*Ruellia nudiflora*), ants (e.g., *Aphelandra scabra*), and bats (e.g., *Louteridium* spp.). Additional floral visitors undoubtedly are attracted to the diverse array of acanthaceous flowers in Guatemala, but they remain unstudied or undocumented. In general, flowers of these and other Acanthaceae are generalists that attract, and can be effectively pollinated by, more than one type of floral visitor.

In addition to the native Acanthaceae occurring in Guatemala, at least 32 species of the family are known to be cultivated in the country. Herbarium specimens document the following species of Acanthaceae as cultivated for ornament in Guatemala: *Acanthus mollis* L., *Aphelandra schiedeana* Schltdl. & Cham., *Asystasia gangetica* (L.) T. Anders., *Crossandra infundibuliformis* (L.) Nees, *Eranthemum pulchellum* Andrews, *Graptophyllum pictum* (L.) Griff., *Hypoestes phyllostachya* Baker, *Justicia aurea* Schltdl., *J. betonica* L., *J. brandegeana* Wassh. & L.B. Sm., *J. carnea* Lindl., *Louteridium donnell-smithii* S. Watson, *Megaskepasma erythrochlamys* Lindau, *Odontonema cuspidatum* (Nees) Kuntze, *O. tubaeforme* (Bertol.) Kuntze, *Pachystachys lutea* Nees, *P. spicata* (Ruiz & Pav.) Wassh., *Pseuderanthemum carruthersii* (Seem.) Guillaumin, *Ruellia brevifolia* (Pohl) Ezcurra, *R. coerulea* Morong, *R. jussieuoides* Schlecht., *R. malacosperma* Greenm., *R. tuberosa* L., *Sanchezia parvibracteata* Sprague & Hutch., *Strobilanthes dyerianus* Mast., *Thunbergia alata* Bojer ex Sims, *T. erecta* (Benth.) T. Anders., *T. fragrans* Roxb., *T. gregorii* S. Moore, *T. grandiflora* Roxb., *T. laurifolia* Lindl., and *T. mysorensis* (Wight) Bedd. Seven of these have escaped cultivation and become naturalized in Guatemala: *Asystasia gangetica*, *Hypoestes phyllostachya*, *Ruellia tuberosa*, *Sanchezia parvibracteata*, *Thunbergia alata*, *T. fragrans*, and *T. grandiflora*. Other cultivated Acanthaceae likely occur or will be found as naturalized or escaped exotics (e.g., *Justicia betonica*, *Ruellia brevifolia*). Indeed, a collection of *Ruellia brevifolia* (=*R. graezicans* Backer) from Santa Rosa (*Flores s.n.*, 5 Nov 1994 at UVAL) was not noted to have been cultivated and might represent a naturalized occurrence. Five or six native Guatemalan Acanthaceae are among the known cultivated ornamentals: *Aphelandra schiedeana*, *Justicia aurea*, *Louteridium donnell-smithii*, *Odontonema cuspidatum* (see below regarding its status as native), *O. tubaeforme* (Bertol.) Kuntze, and *Ruellia jussieuoides*. Other natives are undoubtedly cultivated locally as well (e.g., *Justicia colorifera*, *J. spicigera*). As a result of their growth form and/or floral showiness, additional Guatemalan natives are cultivated outside the country (e.g., *Aphelandra aurantiaca*, *Barleria oenotheroides*, *Odontonema callistachyum*, *Pseuderanthemum alatum*), and others appear worthy of cultivation as ornamentals: *Aphelandra speciosa*, *Bravaisia berlandieriana*, *B. grandiflora*, *Justicia fimbriata*, *J. williamsii*, *Mendoncia lindavii*, *Odontonema steyermarkii*, *Poikilacanthus macranthus*, and *Ruellia maya*.

As might be expected due to extended collecting activities in Guatemala leading to the *Flora of Guatemala*, the largest and most comprehensive collection of Acanthaceae from that nation resides at F. Other collections with significant holdings of Acanthaceae from Guatemala are BIGU, MO, and US. As of 2010, about 40 species of Acanthaceae that are known from Guatemala are not represented by Guatemalan collections in the four major herbaria in Guatemala. However, the

Guatemalan herbaria generally house more recent collections of Acanthaceae than those elsewhere, and many of them are not duplicated elsewhere. The taxonomic infrastructure developed at Guatemalan herbaria has resulted in many important discoveries, and has greatly enhanced knowledge of the flora of northern Central America.

Ecological Diversity. In Guatemala, species of Acanthaceae occur at elevations from sea level (e.g., *Avicennia germinans*, *Ruellia blechum*) to 2800 meters (e.g., *Dyschoriste capitata*, *Odontonema tubaeforme*). Although Acanthaceae occur in most of Guatemala's biotic communities, they are absent from alpine communities (*cf.* Islebe and Cleff 1995). They are especially prevalent in lowland and montane tropical moist to wet forests, cloud forests, evergreen seasonal forests, and tropical dry forests. The most common habitat of Guatemalan Acanthaceae is along watercourses (wet or seasonally dry). Most collections of Guatemalan Acanthaceae do not provide data on vegetation type/biotic community, but based on the information available from collections, personal observations, and known ecological data about Guatemalan species that occur elsewhere in Mesoamerica, it is possible to assign 49 species as restricted to either relatively wet (e.g., mesophytic montane forest, rain forest, cloud forest) or dry (tropical subdeciduous forest, tropical deciduous forest, thornscrub) biotic communities. Of these, forty (82%) are restricted to relatively wet communities and nine (18%) are restricted to dry communities. Others occur in both wet and dry communities or the communities in which they occur in Guatemala are not known. Although many species occur in diverse biotic communities, others appear to be confined to distinctive communities such as manglar (e.g., *Avicennia germinans*), cloud forest (e.g., *Spathacanthus hahnianus*), tropical deciduous forest (e.g., *Justicia ramosa*), lowland rain forest (e.g., *Justicia viridescens*), and aquatic to subaquatic communities (e.g., *Hygrophila costata*). Of the 16 species of Acanthaceae endemic to Guatemala, eight of them are known only from relatively wet biotic communities; none of the endemics is known to occur in the dry communities. This contrasts with dry regions in Chiapas and the Yucatan Peninsula of Mexico, where numerous Acanthaceae are endemic. Although no Acanthaceae are known to be endemic to Guatemala's dry communities, the existence of thornscrub and tropical deciduous forests in Guatemala (e.g., Véliz 2002) has lead to the enrichment of the nation's acanthaceous flora because several widespread species (e.g., *Carlowrightia arizonica*, *Justicia caudata*, *J. ramosa*) occur only in these communities.

Distribution in Guatemala. A geographic summary of species richness among Guatemalan Acanthaceae by department is shown in Figure 1. Departments with the greatest concentrations of species of Acanthaceae are Alta Verapaz (51), Petén (46), Izabal (42), and Huehuetenango (38). Likely reasons for the high numbers of species in these political regions include: size (these four departments are among the five largest in area), collecting activities (at least Huehuetenango, Izabal, and Alta Verapaz are among the better collected departments; MacVean and Davidse 2007), and numbers and types of biotic communities present (e.g., Huehuetenango has a high number of biotic communities and Izabal has the nation's only large region of lowland rain forest, a community in which Acanthaceae are particularly prevalent; see figure 7 in Castañeda 2008 and MAGA 2001). Departments with the least number of acanthaceous species are Totonicapán (1) and Jalapa (7). Reasons for the lack of Acanthaceae in these departments are similar: size (both departments are among the eight smallest in Guatemala), collecting activities (both departments are among the least collected ones; MacVean and Davidse 2007), and numbers/types of communities present (e.g., both departments have relatively few communities, the major one in each being dominated by pine-oak forest, which is generally depauperate in Acanthaceae; see MAGA 2001, Daniel 2005, and figure 7 in Castañeda 2008). Also, Totonicapán is one of the highest (and coldest) departments in the country, and Acanthaceae are generally absent from high/cold regions of the tropics. Surprisingly and somewhat inexplicably, Quiché, the fourth largest department in Guatemala, contains a rela-

FIGURE 2. Guatemalan Acanthaceae I. A. *Aphelandra gigantiflora*. B. *Avicennia germinans*. C. *Chileranthemum pyramidatum*. D. *Bravaisia berlandieriana*. E. *B. grandiflora*. F. *B. integerrima*. G. *Barleria oenotheroides*. H. *Dicliptera guttata*. I. *D. sciadephora*. J. *D. unguiculata*. K. *Dyschoriste quadrangularis*. L. *Elytraria imbricata*. M. *E. bromoides*. Photos by T. Daniel except B (W. Eekerman), C (D. Breedlove), and D (G. Carnevali).

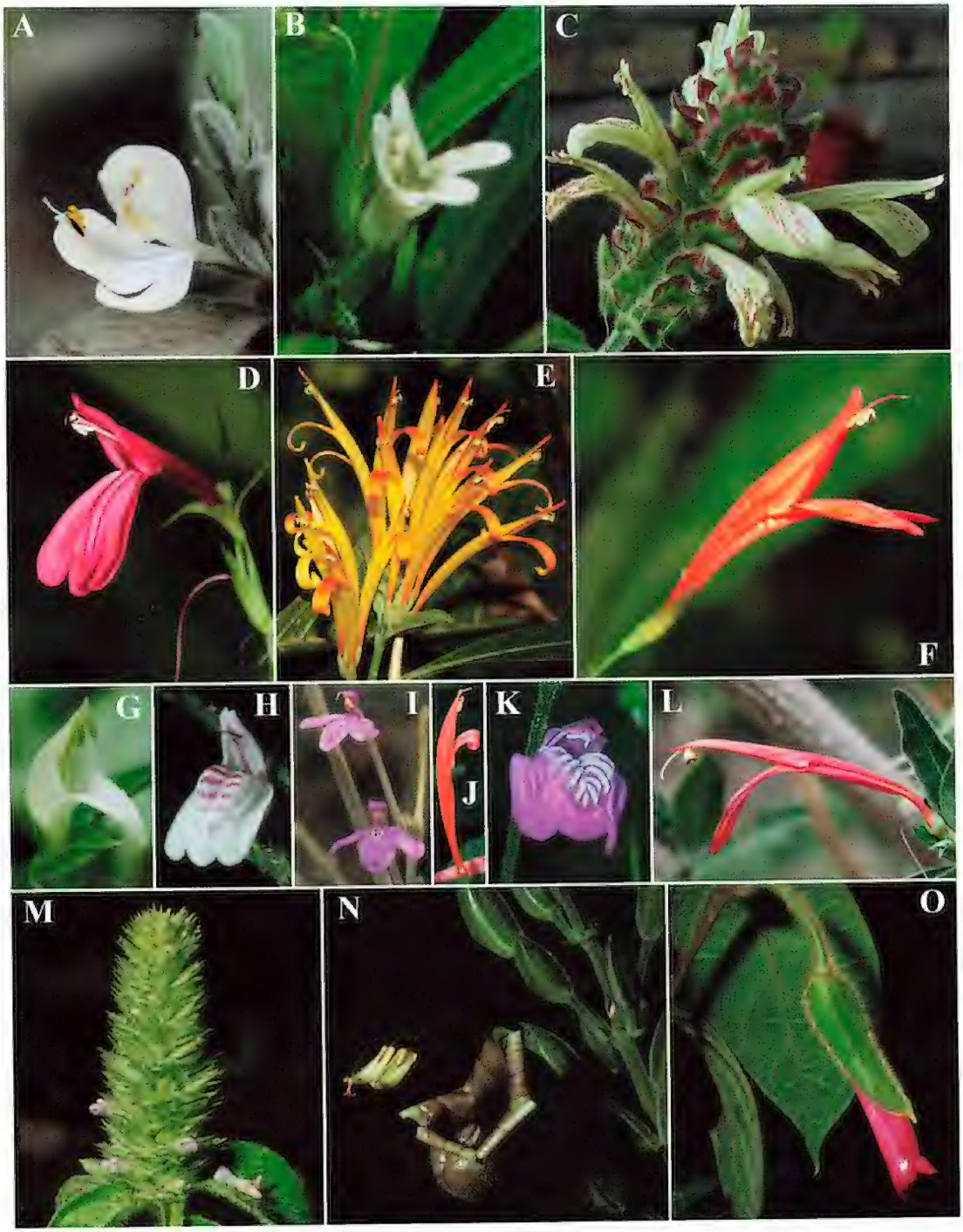


FIGURE 3. Guatemalan Acanthaceae II. A. *Henrya insularis*. B. *Hygrophila costata*. C. *Justicia ciriloi*. D. *J. inaequalis*. E. *J. fimbriata*. F. *J. velizii*. G. *J. viridescens*. H. *J. comata*. I. *J. ramosa*. J. *J. spicigera*. K. *J. pectoralis*. L. *J. williamsii*. M. *Lepidagathis alopecuroides*. N. *Louteridium donnell-smithii*. O. *Mendoncia lindavii*. Photos by T. Daniel except N (D. Breedlove).

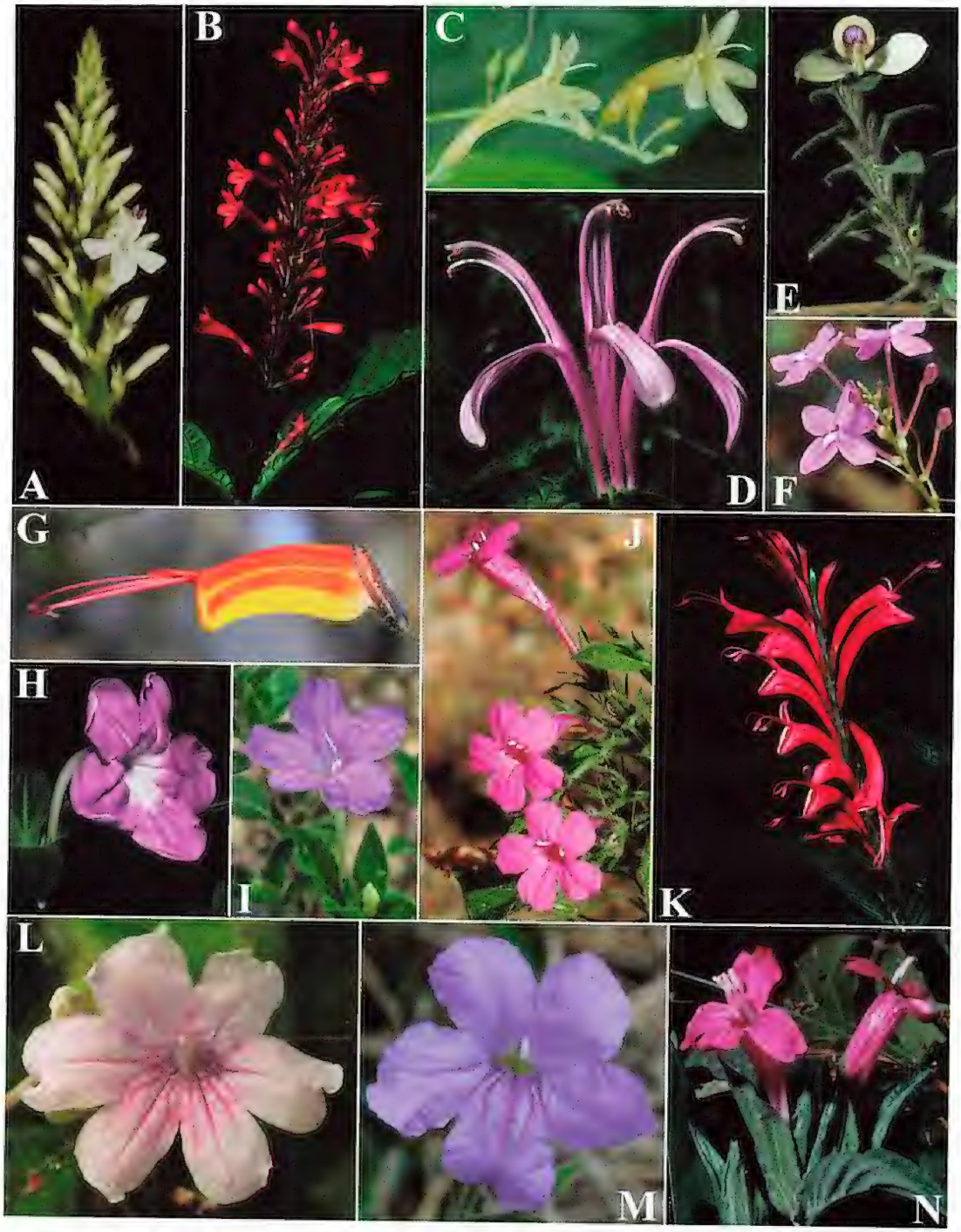


FIGURE 4. Guatemalan Acanthaceae III. A. *Odontonema hondurense*. B. *O. tubaeforme*. C. *O. hondurense*. D. *Poikilacanthus macranthus*. E. *Tetramerium nemorum*. F. *Pseuderanthemum alatum*. G. *Stenostephanus monolophus*. H. *Ruellia maya*. I. *R. hookeriana*. J. *R. inundata*. K. *Razisea spicata*. L. *Ruellia metallica*. M. *R. nudiflora*. N. *R. megasphaera*. Photos by T. Daniel.

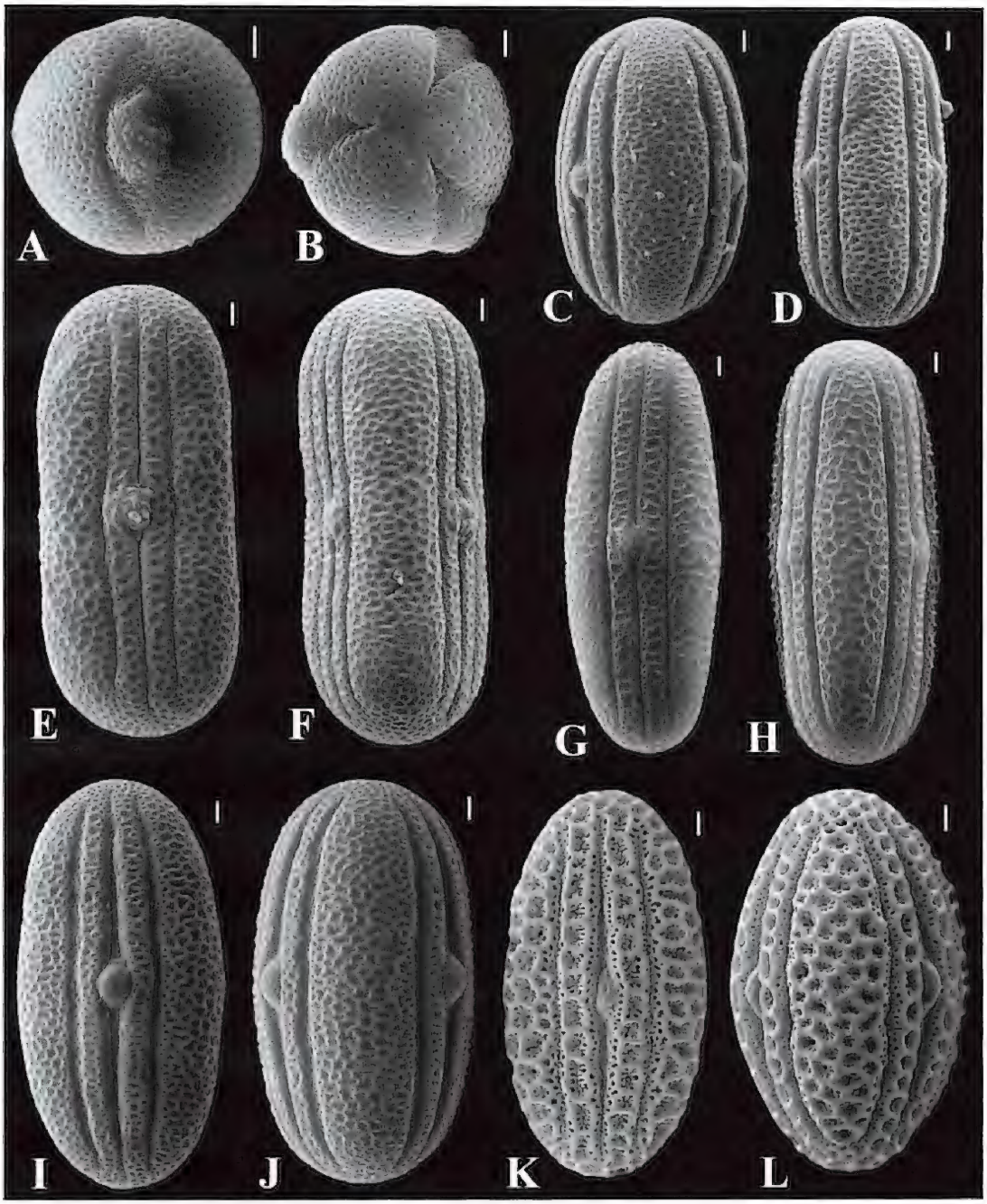


FIGURE 5. Pollen of Guatemalan Acanthaceae I. A. *Avicennia germinans* (*Daniel & Araque 9478*), apertural view of 3-colporate grain. B. *A. germinans* (*Daniel & Araque 9478*), polar view of 3-colporate grain. C. *Dicliptera debilis* (*Standley 91106*), interapertural view. D. *D. inutilis* (*Johnston 1739*), interapertural view. E. *D. sexangularis* (*Daniel et al. 11232*), apertural view. F. *D. sexangularis* (*Daniel et al. 11232*), interapertural view. G. *D. guttata* (*Daniel et al. 11226*), apertural view. H. *D. guttata* (*Daniel et al. 11226*), interapertural view. I. *D. sciadephora* (*Daniel & Véliz 11208*), apertural view. J. *D. sciadephora* (*Daniel & Véliz 11208*), interapertural view. K. *D. unguiculata* (*Daniel & Barreno 11264*), apertural view. L. *D. unguiculata* (*Daniel & Barreno 11264*), interapertural view. Scales = 3 µm.

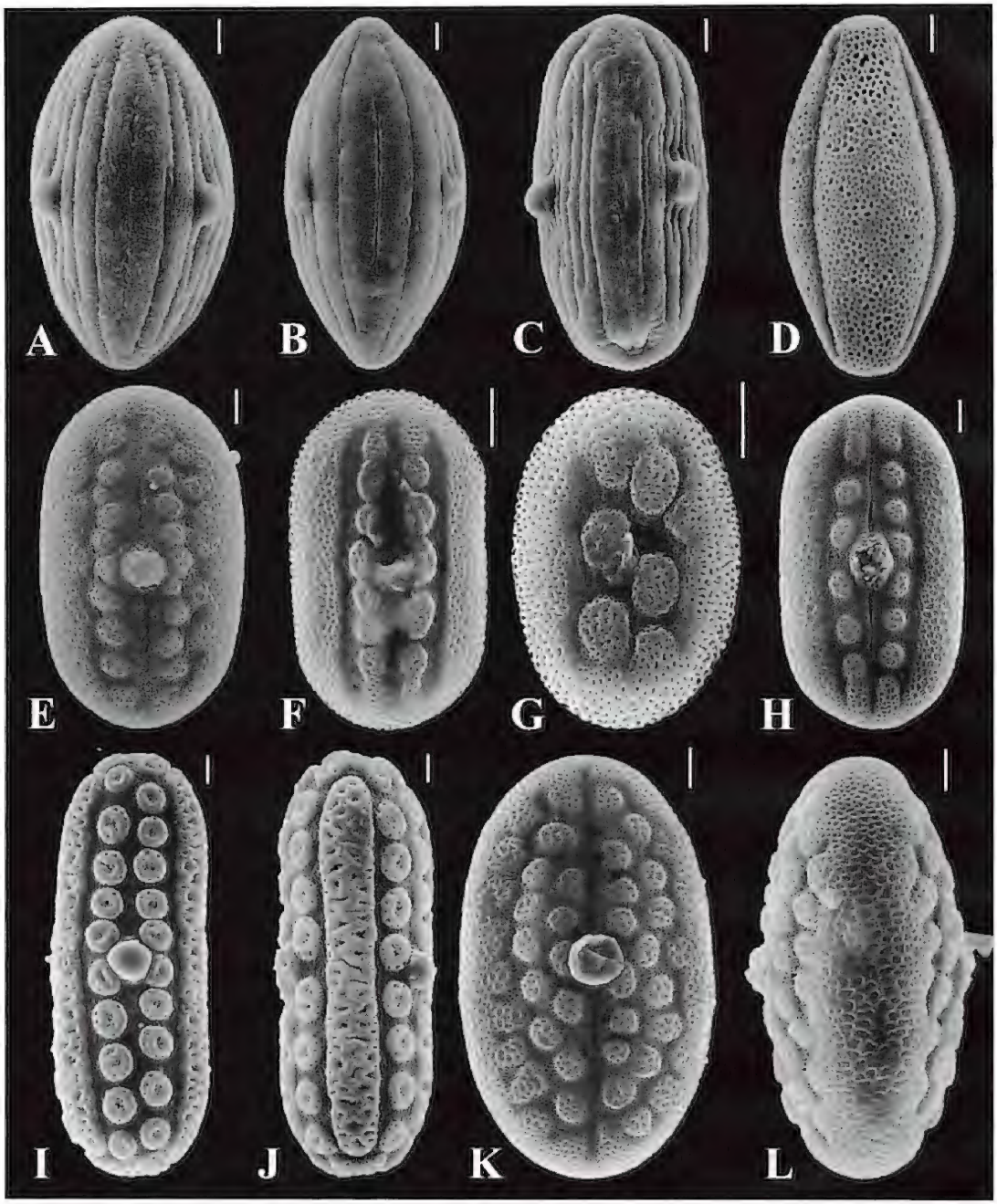


FIGURE 6. Pollen of Guatemalan Acanthaceae II. A. *Dyschoriste capitata* (*Breedlove 26151*), interapertural view. B. *D. ovata* (*Breedlove & Strother 46563*), interapertural view. C. *D. quadrangularis* (*Breedlove & Anderson 63705*), interapertural view. D. *Elytraria bromoides* (*Daniel & Baker 3683*), interapertural view. E. *Justicia bartlettii* (*Breedlove & Almeda 57832*), apertural view. F. *J. candelariae* (*Skutch 2009*), apertural view. G. *J. comata* (*Breedlove 38648*), apertural view. H. *J. kanal* (*Breedlove & Bourell 68262*), apertural view. I. *J. fimbriata* (*Daniel & Bartholomew 4992*), apertural view. K. *J. fimbriata* (*Daniel & Bartholomew 4992*), interapertural view. L. *J. inaequalis* (*Matuda 3990*), apertural view. M. *J. inaequalis* (*Matuda 3990*), interapertural view. Scales = 5 μm.

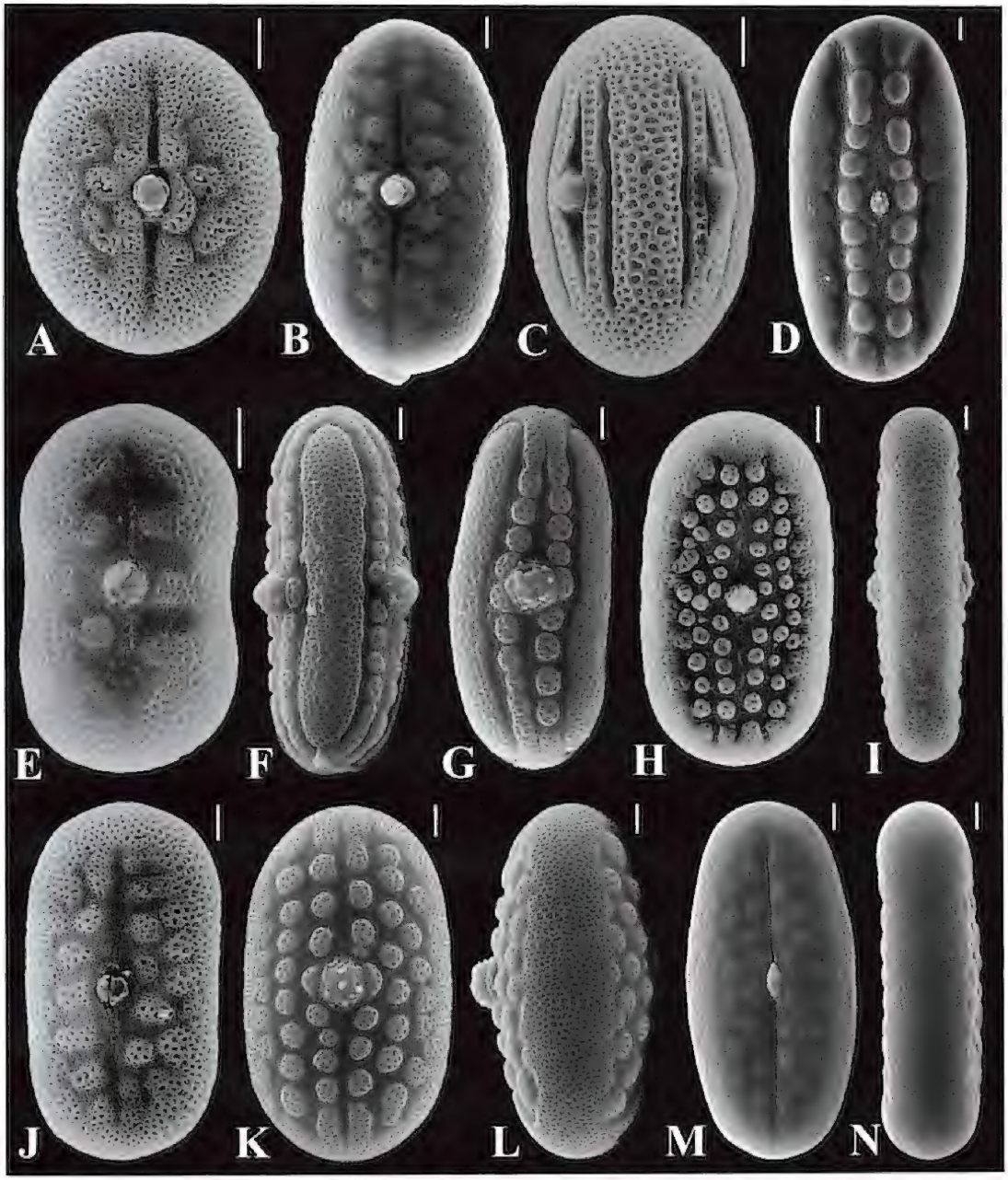


FIGURE 7. Pollen of Guatemalan Acanthaceae III. A. *Justicia lindeniana* (*Breedlove 49908*), apertural view. B. *J. macrantha* (*MacDougall s.n.*), apertural view. C. *J. multicaulis* (*Breedlove 49946*), interapertural view. D. *J. borrerae* (*Breedlove 35290*), apertural view. E. *J. pectoralis* (*Breedlove 48559*), apertural view. F. *J. pedicellata* (*Véliz 95.4376*), interapertural view. G. *J. pedicellata* (*Véliz 95.4376*), apertural view. H. *J. spicigera* (*Breedlove 9431*), apertural view. I. *J. spicigera* (*Avila B. 28*), interapertural view. J. *J. pringlei* (*Breedlove & Strother 46783*), apertural view. K. *J. velizii* (*Contreras 6183*), apertural view. L. *J. velizii* (*Contreras 6183*), interapertural view. M. *J. williamsii* (*Daniel & Barreno 11265*), apertural view. N. *J. williamsii* (*Daniel & Barreno 11265*), interapertural view. Scales = 5 μm.

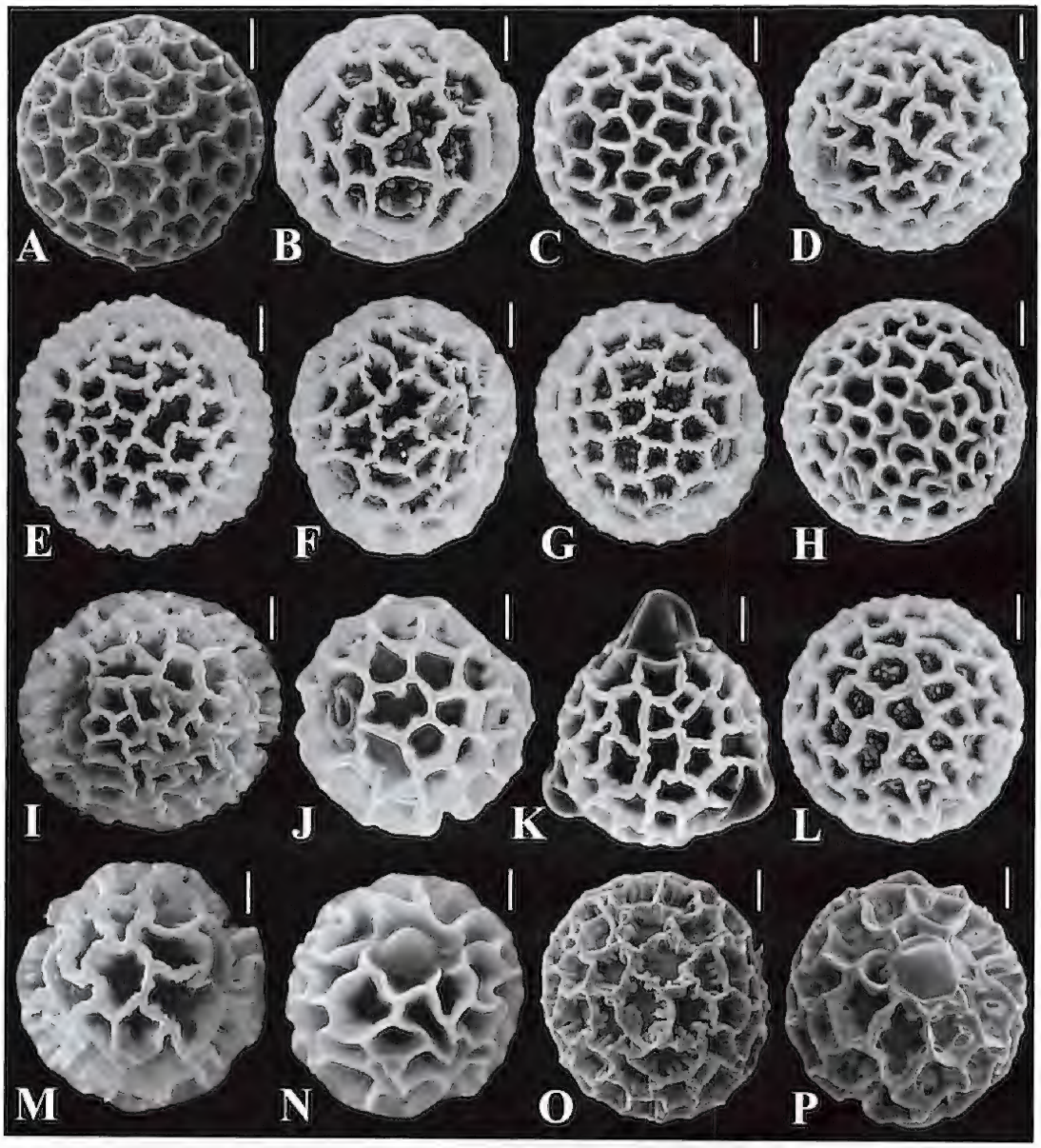
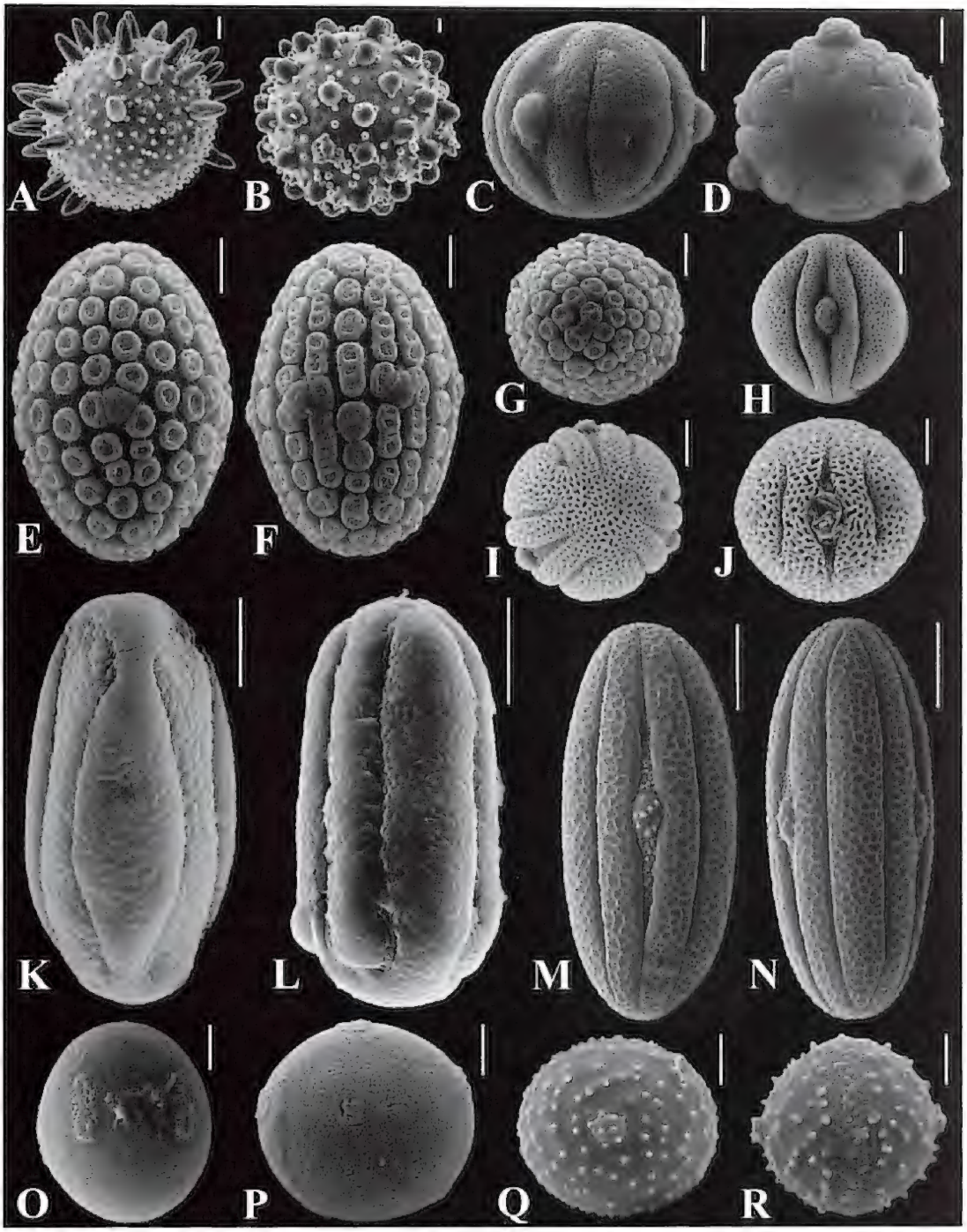


FIGURE 8 (above). Pollen of Guatemalan Acanthaceae IV. A. *Ruellia donnell-smithii* (*Rosales 206*). B. *R. geminiflora* (*Breedlove 9163*). C. *R. harveyana* (*Hernández G. 447*). D. *R. hookeriana* (*Breedlove & Daniel 71060*). E. *R. jussieuoides* (*Breedlove & Almeda 57192*). F. *R. lactea* (*Tenorio L. & Romero de T. 6720*). G. *R. matagalpae* (*Breedlove & Daniel 70899*). H. *R. maya* (*Daniel & Bartholomew 5000*). I. *R. metallica* (*Hammel 8006*). J. *R. paniculata* (*Breedlove & McClintock 23447*). K. *R. pereducta* (*Davidse et al. 20405*), polar view. L. *R. puberula* (*Salinas T. et al. 6898*). M. *R. pygmaea* (*Lundell 18320*). N. *R. pygmaea* (*Lundell 18320*), apertural view. O. *R. spissa* (*Galván & Galván 3297*). P. *R. stemonacanthoides* (*Durkee 83-3*), apertural view. Scales = 10 μm.

FIGURE 9 (right). Pollen of Guatemalan Acanthaceae V. A. *Louteridium donnell-smithii* (*Breedlove 57578*). B. *L. purpusii* (*Breedlove 31613*). C. *Odontonema steyermarkii* (*Standley 88361*), equatorial view. D. *O. steyermarkii* (*Standley 88361*), polar view. E. *Poikilacanthus skutchii* (*Breedlove & Almeda 64860*), apertural view. F. *P. skutchii* (*Breedlove & Almeda 64860*), interapertural view. G. *P. skutchii* (*Breedlove & Almleda 64860*), polar view. H. *Pseuderanthemum verapazense* (*Wendt et al. 3113*), apertural view. I. *P. alatum* (*Daniel & Baker 3713*), polar view. J. *P. cuspidatum* (*Breedlove &*



Daniel 70880), apertural view. K. *Stenandrium pedunculatum* (*Bullock 1366*), interapertural view. L. *S. subcordatum* (*Chater et al. 3*), subapertural view. M. *Tetramerium nemorum* (*Daniel et al. 11214*), apertural view. N. *T. nemorum* (*Daniel et al. 11214*), interapertural view. O. *Mendoncia lindavii* (*Evans 1630*), equatorial view. P. *M. lindavii* (*Evans 1630*), polar view. Q. *Stenostephanus azureus* (*Williams et al. 25595*), apertural view. R. *S. azureus* (*Williams et al. 25595*), interapertural view. Scales = 10 μm.

tively low number of Acanthaceae. Additionally, there does not appear to be a consistent positive correlation between relative numbers of different geologic substrates in departments (based on Bonis et al. 1975) and species richness of Acanthaceae. For example, whereas Izabal and Huehuetenango have high numbers of species and geologic substrates, Alta Verapaz has high numbers of species but very few types of geologic substrates and Quiché has a relatively low number of species but many geologic substrates. These and other factors that influence species richness and diversity in Guatemala were discussed by Castañeda (2008).

Twenty-nine species of Acanthaceae are known from only a single department in Guatemala. These include local Guatemalan endemics (e.g., *Dicliptera debilis*, *D. guttata*, *Justicia gibsoniae*, *J. neomontana*, *J. steyermarkii*, *J. viridescens*, *Poikilacanthus pansamalanus*), species endemic to Guatemala and adjacent regions in one or more surrounding nations (e.g., *Bravaisia berlandieriana*, *Dicliptera antidysenterica*, *Justicia albobractea*, *J. ciriloi*, *J. tianguensis*, *Ruellia maya*, *Spathacanthus hahnianus*), widely distributed species that are rare in Guatemala (e.g., *Justicia ramulosa*, *Pseuderanthemum alatum*), and species that attain the northwestern (e.g., *Razisea spicata*) or southeastern (e.g., *Dicliptera thlaspioides*) extent of their distributions by a single known occurrence in the country near its western or eastern borders.

Species of Acanthaceae that have the broadest distribution in Guatemala (based on occurrences by department) are *Aphelandra scabra* (19), *Elytraria imbricata* (17), *Justicia aurea* (16), *Ruellia blechum* (14), and *Odontonema tubaeforme* (13). *Aphelandra scabra*, a shrub, is likely so widely distributed in Guatemala because of its ecological amplitude, which enables it to occur at low to high elevations (0—1850 m) in both relatively wet and relatively dry habitats. The broadly distributed (North America, Central America, West Indies, and South America) perennial herbs *Elytraria imbricata* and *Ruellia blechum* are particularly weedy (especially in disturbed habitats) and occur over considerable ranges of elevation. The shrubs *Odontonema tubaeforme* and *Justicia aurea* have more restricted distributions (North America and Central America), are generally restricted to moist to wet forests, but have substantial elevational ranges (e.g., 50–2800 m for *O. tubaeforme*). Thus, although this group of five species shows diversity in habit and habitat, their tendency toward weediness and/or their considerable ecological/elevational amplitude likely help to explain their broad geographic occurrences in Guatemala.

Conservation. The conservation status has not been determined for any Guatemalan Acanthaceae based on the IUCN red list criteria (IUCN 2009). However, 29 Guatemalan Acanthaceae were included in the *1997 IUCN Red List of Threatened Plants* (Walter and Gillett 1998), and 17 species were listed as threatened in Guatemala by the Consejo Nacional de Áreas Protegidas (CONAP 2006). Guatemalan Acanthaceae listed by the IUCN (Walter and Gillett 1998), with their status in Guatemala, consist of: *Aphelandra speciosa* (rare), *Bravaisia grandiflora* (rare), *Dicliptera antidysenterica* (not listed from Guatemala; rare in Honduras), *D. debilis* (indeterminate), *D. guttata* (indeterminate), *D. inutilis* (indeterminate), *D. membranacea* (vulnerable), *Stenostephanus azureus* (as *Habracanthus azureus*; rare), *S. latilabris* (as *Habracanthus latilabris*; rare), *S. ruberrimus* (as *Habracanthus ruberrimus*; rare), *Henrya insularis* (as *H. gualanensis*; indeterminate), *Justicia bartlettii* (indeterminate), *J. borrerae* (rare), *J. gibsoniae* (as *J. grandiflora*; rare), *J. neomontana* (as *J. montana*; rare), *J. multicaulis* (vulnerable), *J. pedicellata* (rare), *J. ramosa* (as *Siphonoglossa ramosa* var. *discolor* and as *S. ramosa* var. *hondurensis*; indeterminate), *J. silvicola* (rare), *J. steyermarkii* (indeterminate), *J. sulfurea* (vulnerable), *J. viridescens* (as *Megalostoma viridescens*; vulnerable), *Lepidagathis guatemalensis* (as *Lophostachys guatemalensis*; rare), *Louteridium purpusii* (as *L. mexicanum*; rare), *Poikilacanthus macranthus* (as *P. setiferus*; rare), *P. pansamalanus* (vulnerable), *P. skutchii* (rare), *Schaueria parviflora* (as *Streblacanthus parviflorus*, vulnerable), and *Stenandrium subcordatum* (rare). All 17 species of Acan-

thaceae listed by CONAP (2006) were noted to be taxa that are not in danger of extinction at present but which could become so if not regulated. They consist of *Chileranthemum pyramidatum*, *Dicliptera debilis*, *D. guttata*, *D. inutilis*, *Henrya insularis* (as *H. gualanensis*), *Justicia gibsoniae* (as *J. grandifolia*), *J. neomontana* (as *J. montana*), *J. silvicola*, *J. steyermarkii*, *J. sulfurea*, *J. viridescens* (as *Megalostoma viridescens*), *Poikilacanthus pansamalanus*, *P. skutchii*, *Schaueria parviflora* (as *Streblacanthus parviflorus*), *Stenostephanus azureus* (as *Habracanthus azureus*), *S. latilabris* (as *Habracanthus latilabris*), and *S. ruberrimus* (as *Habracanthus ruberrimus*).

In this study, the numbers of known collections (mostly from different localities) and date of collections ("recent" refers to collections made since 1985) were taken into account to provide some assessment of relative rarity among Guatemalan Acanthaceae. Although numerous species either have been treated as "threatened" in some way by others (e.g., Walter and Gillett 1998; CONAP 2006) or are here considered to be rare (i.e., known by multiple collections from only a single locality or by no more than three collections from different localities) to possibly extirpated in Guatemala, they occur, sometimes abundantly, in other countries. These species (along with notes relevant to their conservation status) are:

Aphelandra speciosa (known by more than 10 collections, some of them recent, from Chiapas, Mexico and three departments in Guatemala, suggesting that the species is not at risk at present; Daniel 1991a),

Bravaisia grandiflora (known by more than 20 collections, some of them recent, from Mexico, Belize, and four departments in Guatemala, suggesting that the species is not at risk; Daniel 1988),

Chileranthemum pyramidatum (although known from relatively few collections in two departments of Guatemala, the species has been collected several times recently in Huehuetenango; it also occurs in El Salvador and at least three states in Mexico, where it is known from sufficient populations to suggest that the species is not currently at risk; Daniel 1995a, 1995b, 2001),

Dicliptera antidysenterica (known from one or more historical collections from Guatemala and at least six collections, including recent ones, from Honduras; the overall status of the species remains unknown; Daniel 2005),

Dicliptera inutilis (known only by two collections, made between 1930 and 1941, from two departments in Guatemala, and by a possible occurrence in Belize, based on a recent collection; the overall status of the species is unknown; Daniel 1997a),

Dicliptera membranacea (known from numerous collections, including recent ones, from various states of Mexico and at least two [possibly three, see below] departments in Guatemala, suggesting that the species is not at risk at present; Daniel 2009),

Dicliptera thlaspioides (widely distributed and collected in Mexico, and known from a single locale in Guatemala; recent collections have been made in both nations, and the species would not appear to be at risk; Daniel 2009),

Henrya insularis (occurs throughout much of Mexico and Central America, sometimes abundantly, and is not at risk; Daniel 1990a),

Justicia hartlettii (known from sufficient collections, including recent ones, in Mexico, Belize, and Guatemala to suggest that the species is not at risk; Daniel 1995b),

Justicia horrerae (known from sufficient collections, including recent ones, in Mexico and two departments in Guatemala so that the species would not appear to be at risk; Daniel 1995b),

Justicia ciriloi (known by three collections from two departments in Honduras, made in the early 1980s, and the type, collected in 1939 in Guatemala; the species is likely either rare or possibly extirpated in Guatemala; its overall status remains unknown; Daniel 2005),

Justicia clinopodium (although rare in Guatemala, the species is known from sufficient collections, including recent ones, from several states in Mexico to suggest that the species is not at risk; Daniel 1995b),

Justicia lindeniana (although rare in Guatemala the species is known from 10 or more collections in several states of southern Mexico; its overall status remains unknown; Daniel 1995b),

Justicia multicaulis (known by at least five collections from Chiapas and by collections, including at least one recent one, from three departments in Guatemala; its overall status remains unknown; Daniel 1995b),

Justicia pringlei (although rare in Guatemala the species is known from sufficient collections, including recent ones, from numerous states in Mexico that the species is not at risk; Daniel 1995b),

Justicia ramosa (known from three departments in Guatemala, Mexico, Central America, and northern south America, including recent collections in most regions; the species is often abundant where it occurs, and is not at risk; Daniel 1995b, 2005),

Justicia ramulosa (although rare in Guatemala, the species is known from several nations of Central America and South America; recent collections have been made in several of these and the species is not at risk; Daniel 2005),

Justicia sulfurea (known from two departments in Guatemala and by at least two occurrences in El Salvador, this species was last collected in 1972, and its overall status remains unknown; Daniel 2004a),

Justicia tianguensis (known only by the the type from Chiapas and a single collection from Guatemala made in 1969; the species is likely rare or endangered; Daniel 1995a, 1995b),

Justicia valvata (known from a single locale in Guatemala, and collected at least three times in Veracruz, Mexico; the species was last collected in 1982, and it appears to be rare; Daniel 2003),

Lepidagathis guatemalensis (known from three departments in Guatemala, the species also occurs and has been collected recently in both southern Mexico and El Salvador; it is likely not currently at risk; Daniel 1993a, 2008),

Louteridium purpusii (known from several collections from two departments in Guatemala and by at least five collections from Chiapas, Mexico; the overall status of the species remains unknown; Daniel 1995b),

Mendoncia guatemalensis (known from a single department in Guatemala where rarely collected; the species is known by recent collections from Mexico and Honduras; the overall status of this species is unknown; Daniel 1992, 2005),

Poikilacanthus macranthus (known by numerous collections, including recent ones, from eight departments in Guatemala and from southern Mexico to Panama; this species is not at risk; Daniel 1991b, 1995b),

Pseuderanthemum alatum (although known only from a single department in Guatemala where it is uncommonly, but recently, collected, this species is known by numerous, and often recent, collections from Mexico to Nicaragua; it is not currently at risk; Daniel 1995b),

Razisea spicata (although known only by a single collection made in 1941 from Guatemala, this species is known from numerous, often recent collections, from Nicaragua to Colombia; it is not currently at risk; Durkee 1978, 1986),

Ruellia maya (known by at least five historical collections and a recent collection from a single department in Guatemala, this species is known by at least 15 collections, including recent ones, from Chiapas, Mexico; it does not appear to be at risk at present; Daniel 1995a, 1995b),

Schaueria parviflora (known by few collections from a limited region of Guatemala, the species also occurs in Oaxaca and Veracruz, Mexico, where it is known from at least one protected region and has been collected recently; it does not appear to be currently at risk; Daniel 1990b, 2004c),

Spathacanthus hahnianus (although very rare or possibly extirpated in Guatemala, where known only from an 1886 type collection, the species is known by recent collections from various localities both in Mexico and Honduras; the species is not at risk at present; Daniel 1999b, 2005),

Stenandrium dulce (although known from only a few collections in two departments of Guatemala, this species is widespread, often locally abundant, and found in several biotic communities from the southern USA to Chile; it is not at risk; Daniel 1985),

S. subcordatum (although rarely collected in Guatemala and known from a single department, it was collected there as recently as 1992; the species is more abundant, and has been recently collected in the Yucatan Peninsula of Mexico; it would not appear to be at risk at present; Daniel 1985, 2008),

Stenostephanus latilabris (known from a recent collection from one department and historical collections from two others in Guatemala and from a small region in Chiapas, Mexico where last collected in 1989; although the 2010 collection from San Marcos came from a population of several hundred plants, the overall conservation status of the species remains unknown; Daniel 1999c), and

Tetramerium tenuissimum (known from more than 50 collections, many of them recent, from northern Mexico to El Salvador; the species is not at risk; Daniel 1986, 2001, 2004b).

By contrast, the sixteen species of Acanthaceae endemic to Guatemala are represented nowhere else, and their conservation status is of greater concern. Notes relevant to the conservation status of each of them are provided in the species accounts below. At least six of these Guatemalan endemics (*Justicia pedicellata, J. velizii*, *Odontonema steyermarkii*, *Poikilacanthus skutchii*, *Stenostephanus azureus*, and *S. ruberrimus*) appear to be extant (based on a collection made in the past 20 years) and known from sufficient collections and localities that they do not appear to be in imminent danger of extinction. On the other hand, 10 species (*Dicliptera debilis*, *D. guttata*, *Justicia gibsoniae*, *J. neomontana*, *J. sangilensis*, *J. silvicola*, *J. steyermarkii*, *J. viridescens*, *J. williamsii*, and *Poikilacanthus pansamalanus*) are rare and/or have not been collected within the past two decades. Some of these are rare, but extant (as of 2009): *D. guttata*, *J. sangilensis*, *J. viridescens*, and *J. williamsii*. For the others, their status is unknown. They remain known only by their respective type (including paratype) collections, made between 67 and 123 years ago. Attempts to relocate these species will undoubtedly provide useful information as to whether they remain extant or not. It should be noted that for species here considered rare (based on the criterion noted above) population sizes have usually not been estimated, and the absence of additional collections of them might reflect inadequate sampling rather than actual rarity. Indeed, the chances of relocating some or all of the endemics that have not been collected in the past 20 years appears promising based on the successful results of our attempts to relocate *Dicliptera guttata* and *Justicia williamsii* (both of which were known only from their respective types) in 2009.

Although Acanthaceae are widespread in Guatemala, and occur in diverse plant communities, several regions are noteworthy because they harbor both endemic and high numbers of non-endemic species of the family. These "hotspots" include: Sierra de los Cuchumatanes in Huehuetenango, Montañas del Mico (particularly the Cerro San Gil) and the lowland rain forests surrounding the Bahía de Gálvez (Bahía de Santo Tomás) in Izabal, Sierra de Chamá and the vicinity of Pansamalá in Alta Verapaz, Sierra de las Minas in several departments, slopes of Volcán Zunil in Quetzaltenango, montane slopes above San Rafael Pie de la Cuesta in San Marcos, and the vicinity of La Cumbre in southeastern Petén. Several of these regions were noted by Véliz (2008) as having a high incidence of endemism for Guatemalan plants. Some of these regions currently have or include protected areas (e.g., Sierra de las Minas, Cerro San Gil; CONAP 2007). Among those departments with high numbers of Acanthaceae, Petén and Izabal have numerous, large protected areas whereas Huehuetenango has few and relatively small ones (CONAP 2007; Castañeda 2008). Ultimately, to maintain the richness and diversity of Guatemalan Acanthaceae, preservation of diverse biotic communities throughout the nation will be necessary.

Taxonomic Catalog

***Aphelandra aurantiaca* Lindl.**

Recent descriptions.— Daniel (1991a, 1995b).

Phenology.— Flowering: throughout the year; fruiting: January–June.

Habitats.— Lowland rain forests, montane rain forests, mesophytic forests, tall forests, short forests, zapotales, montane ridges and summits, clearings, along streams, ravines; 0–1350 m.

Local name.— "Flor de rosario" (*Johnson 67*).

Alta Verapaz: *von Tuerckheim 8254* (F, US). **Baja Verapaz**: *von Tuerckheim 3942* (US). **Huehuetenango**: *Steyermark 49248* (F, MICH, US). **Izabal**: *Steyermark 41685* (F). **Petén**: *Tún Ortíz 1826* (F, MO).

Gibson (1974) recognized *A. repanda* Nees as distinct from *A. aurantiaca*; Daniel (1995b) treated them as conspecific.

***Aphelandra gigantiflora* Lindau**

RECENT DESCRIPTIONS.— Daniel (1991a, 1995b).

PHENOLOGY.— Flowering: November–March; fruiting: February.

HABITATS.— Moist to wet forests, wooded ravines; 425–1200 m.

Chimaltenango: *Johnston 1549* (F). **Escuintla**: *Standley 89506* (holotype of *A. gigantiflora* f. *lutea* Standl. & Steyerm.: F). **Guatemala**: *Donnell-Smith 2696* (US). **Sacatepéquez**: *Standley 58132* (F, US).

Gibson (1974) treated this taxon as a variety of *A. schiedeana*; Daniel (1991a) treated it as a distinct species. The type of *A. gigantiflora* (*Warscewicz s.n.* at GH) was presumably collected from an unknown locale in Guatemala. Although the specimen indicates "Guatemala et Costarica," the species is not known from the latter nation. A yellow-flowered form of the species, based on Guatemalan plants noted above, was not treated as distinct by either Gibson (1974) or Daniel (1991a).

***Aphelandra heydeana* Donn. Sm.**

RECENT DESCRIPTIONS.— Daniel (1991a, 1995b).

PHENOLOGY.— Flowering: September–December; fruiting: February.

HABITATS.— Moist to wet forests, cloud forests, oak woodland/pastures, thickets; 1060–1800 m.

LOCAL NAME.— "Flor de S. Julián" (*Morales R. 1175*)

Guatemala: *Davidson 3249* (ENCB, F, MO, RSA). **Huehuetenango**: *Madison 1769* (GH). **Santa Rosa**: *Heyde & Lux 4037* (holotype: US; isotype: MO).

***Aphelandra scabra* (Vahl) Sm.**

RECENT DESCRIPTIONS.— Daniel (1991a, 1995b).

PHENOLOGY.— Flowering: throughout the year; fruiting: November–June.

HABITATS.— Moist evergreen forests, tropical deciduous forest-oak forest transition, pine forests, dry forests, tall forests, short forests, zapotales, moist thickets, dry thickets, savannas with trees and shrubs, wet cliffs, ravines, brushy slopes, disturbed sites (e.g., roadsides, cafetales); 0–1850 m.

LOCAL NAMES.— "Chacanal" (*Veintimilla & César 10205*), "flor de San Julián" (*Pérez 274*), "sic chá" (*Goll 3*), "tintillo" (*de Castillo s.n.* 23 III 1947).

Alta Verapaz: *Steyermark 45603* (F). **Baja Verapaz**: *Daniel & Véliz 11329* (BIGU, CAS, MO). **Chimaltenango**: *Johnston 567* (F). **Chiquimula**: *Molina R. & Molina 26782* (F, MICH). **El Progreso**: *García & Cóbar MG882* (BIGU, MO, USCG). **Escuintla:** *Velasquez s.n.* (holotype of *Justicia rostrata* Bertol.: BOLO). **Guatemala**: *Standley 59601* (F). **Huehuetenango**: *Williams et al. 41247* (F, US). **Izabal**: *Contreras 5959* (F, LL, MO). **Jalapa**: *Standley 77087* (US). **Jutiapa**: *Standley 75121* (F, US). **Petén**: *Contreras 7017* (F, MO, US). **Quezaltenango**: *Skutch 1370* (F, US). **Quiché**: *Aguilar 1054* (F). **Retalhuleu**: *Standley 87650* (F, US). **Santa Rosa**: *Standley 78702* (F, US). **Sololá**: *Shannon 154* (US). **Suchitepéquez**: *Standley 62184* (F, US). **Zacapa**: *Steyermark 42150* (F, US).

Gibson (1974) treated this species with the name *A. deppeana* Schlecht. & Cham., a taxonomic synonym (see Daniel 1991a). This is one of the most widespread (occurring in wet to dry habitats) and conspicuous of acanthaceous shrubs in Central America; it is commonly collected.

***Aphelandra schiedeana* Schlecht. & Cham.**

RECENT DESCRIPTIONS.— Daniel (1991a, 1995b).

PHENOLOGY.— Flowering: October–March; fruiting: December–March.

HABITATS.— Moist to wet forests, moist evergreen montane forests, cloud forests, slopes, along streams; 600–2440 m.

Chimaltenango: *Daniel & Véliz 11201* (BIGU, CAS, K, MO). **Escuintla**: *Standley 61283* (F). **Guatemala**: *MacVean & Escobar 1027* (UVAL). **Huehuetanango**: *Véliz et al. 16058* (BIGU). **Quezaltenango**: *Standley 83352* (F, US). **Quiché**: *Skutch 1724* (F, US). **Sacatepéquez**: *Daniel & Véliz 11200* (BIGU, BR, CAS, K, MO, US). **San Marcos**: *Daniel et al. 11314* (BIGU, CAS, MO).

***Aphelandra speciosa* Brandegee**

RECENT DESCRIPTIONS.— Daniel (1991a, 1995b).

PHENOLOGY.— Flowering: January, May–October; fruiting: March, July, October.

HABITATS.— Moist to wet forests, mixed forests; 900–1800 m.

LOCAL NAMES.— "Crucita de mayo" (*de Castillo 2722*), "flor de la Santa Cruz de mayo" (*Steyermark 33415*); "flor de mayo" (*Steyermark 37220*).

Quezaltenango: *Steyermark 33415* (F). **San Marcos**: *J. Morales et al. 528* (F, USCG). **Suchitepéquez**: *Steyermark 46800* (F, US).

***Asystasia gangetica* (L.) T. Anders.**

RECENT DESCRIPTION.— Daniel and Figueiredo (2009).

PHENOLOGY.— Flowering: January; fruiting: unknown.

HABITATS.— Disturbed sites (e.g., roadsides); ca. 25 m.

Izabal: *Daniel et al. 11242* (CAS).

This native of Africa and southern Asia was recently found to be naturalized in a region of lowland rain forest. It has been reported from elsewhere in Central America (e.g., Belize, Honduras, Nicaragua, Costa Rica, Panama; Durkee 1978, 1986, 2001; Daniel 1997a, 2005).

***Avicennia germinans* (L.) Stearn**

RECENT DESCRIPTIONS.— Pool (2001), Correll and Correll (1982).

PHENOLOGY.— Flowering: March–August; fruiting: March, August–September.

HABITATS.— Salt marshes, tidal flats, mangrove swamps, esturine borders; at or near sea level (–200 m [?]) on both Pacific and Caribbean coasts.

LOCAL NAMES.— "Ixtaten" (*Lara s.n.*), "madre sal" (*Arrecis 47*), "mangle blanco" (*Véliz & Véliz 94.4076*); "mangle negro" (*Arrecis 121*).

Escuintla: *Véliz & Véliz 94.4076* (BIGU). **Izabal:** *Standley 72167* (F). **Jutiapa**: *Arrecis 121* (BIGU, USCG). **Retalhuleu**: *Arrecis s.n.* III-1995 (BIGU). **San Marcos**: *Arrecis 50* (USCG). **Santa Rosa**: *Lara s.n.* (USCG).

Avicennia is usually treated either in Verbenaceae (e.g., Gibson 1970) or Avicenniaceae. Molecular phylogenetic studies (Schwarzbach and McDade 2002; McDade et al. 2008) reveal it to be nested among Acanthaceae s.l., and either related to *Thunbergia* and *Mendoncia* of subfamily Thunbergioideae or sister to subfamily Acanthoideae. As noted by Jarvis (2007), "there has been disagreement over the correct name for this taxon—see Little (in *Phytologia* 8:49–57. 1961) who argued that it should be *A. nitida* Jacq., and Compère (in *Taxon* 12:150. 1963) who favoured *A. germinans* (L.) L."

The black mangrove is often an abundant shrub or tree of tropical shorelines and coastal swamps where it is an important constituent of mangrove communities. Pneutomatophores (aerial,

pencil-like roots evident at least at low tide) and viviparous seeds (that swell and can germinate prior to falling) are characteristic of the genus. Gibson (1970:179) noted that the flowers are reputed "to be much visited by bees and to supply a good grade of honey." Some of the economic uses of *A. germinans* were summarized by Cheatham et al. (2000).

In addition to the coastal departments noted above, the species likely occurs or occurred along the coasts of Quezaltenango and Suchitepéquez as well. *Avicennia germinans* also occurs in the southern USA (Florida and Texas) and throughout coastal regions of the West Indies, Mexico, Central America, the Galapágos Islands, and the Pacific coast of South America (to Peru). It also occurs on the Carribean and Atlantic coasts of South America (possibly to northern Brazil), where it distribution and taxonomy become entangled with *A. schaueriana* Stapf & Leechman ex Moldenke. Plants of western Africa are sometimes referred to *A. africana* Beauvois (e.g., Moldenke 1960), but are usually treated as *A. germinans* (e.g., Gibson 1970; Stearn 1958; Tomlinson 1986; Daniel and Figueiredo 2009). Moldenke (1960) treated *A. germinans* as a strictly American species and provided an account of it that included a description, discussion, and list of specimens; he also listed numerous additional synonyms and illustrations he believed to be referable to the species.

Pollen of *A. germinans* from Africa (*Daniel 11120*) and tropical America (*Daniel 9478*) shows similar patterns of variation: shape varying from spheric to ± prolate and apertures varying from 3-colpate to 3-colpoidate to 3-colporate (Fig. 5).

Gibson (1970) included *Avicennia bicolor* Standl. in her account of the Guatemalan taxa because of its expected occurrence in the country. Although it occurs in surrounding regions (e.g., Chiapas, El Salvador, and Honduras), this species has not yet been documented from Guatemala. In Mexico and Central America, the two species can be distinguished using the following couplet:

1. Inflorescence of ± open panicles of spikes, pairs of flowers (3–) 4.5–9 mm distant along rachis, rachis clearly visible between pairs; corolla 4.5–6 mm long, lobes internally glabrous; leaves elliptic to broadly elliptic, 1.4–2.6 × longer than wide; young stems lacking a whitish covering of pubescence ..... *A. bicolor*
1. Inflorescence of densely flowered spikes, pairs of flowers congested at or toward apex of rachis, 1.5–4 mm distant, rachis often not or but barely visible between pairs; corolla 5–7.5 mm long, lobes internally pubescent; leaves lance-elliptic to narrowly elliptic to elliptic (to obovate), (2.1–) 2.5–6.4 × longer than wide; young stems with a whitish covering of pubescence ..... *A. germinans*

***Barleria oenotheroides* Dum. Cours.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: August–January; fruiting: January–May, October.

HABITATS.— Moist forests, short forests, tall forests, ramonales, along streams, thickets, clearings; 250–1700 m.

Baja Verapaz: *Daniel & Véliz 11330* (BIGU, CAS, MO). **Chiquimula**: *Molina R. & Molina 25327* (F). **Escuintla**: *Standley 89497* (F, US). **Huehuetenango**: *Williams et al. 41380* (F). **Izabal**: *Lundell & Contreras 18900* (LL, MO, US). **Petén**: *Contreras 7482* (F, MO, US). **Santa Rosa**: *Heyde & Lux 3117* (US).

Gibson (1974) treated this species with the name *B. micans* Nees, a taxonomic synonym (see Daniel 1995a).

***Bravaisia berlandieriana* (Nees) T.F Daniel**

RECENT DESCRIPTION.— Daniel (1988).

PHENOLOGY.— Flowering: April; fruiting: April–May.

HABITATS.— Shorelines or areas subject to inundation; 50–80 m.

LOCAL NAME.— "Juluba" (*Morales et al. 150*).

Petén: *Contreras 8369* (LL, MO, US).

Gibson (1974) treated this species with the name *B. tubiflora* Hemsl., a taxonomic synonym (see Daniel 1988). Although uncommon in Guatemala, this species is widespread and locally abundant in Belize and Mexico. Flowers of the three species of *Bravaisia* are shown in Figure 2.

***Bravaisia grandiflora* Donn. Sm.**

RECENT DESCRIPTIONS.— Daniel (1988, 1995b).

PHENOLOGY.— Flowering: February–April; fruiting: unknown.

HABITATS.— Tall forests, along streams; 180–850 m.

LOCAL NAME.— "Boc-che'" (*Johnson 187*; Keckchí dialect).

Alta Verapaz: *von Tuerckheim 7924* (holotype: US). **Huehuetenango**: *Lopez 4* (USCG). **Izabal**: *Tún Ortíz 2351* (BM, F, MICH, US). **Petén**: *Contreras 6695* (K, LL, MO, US).

***Bravaisia integerrima* (Spreng.) Standl.**

RECENT DESCRIPTIONS.— Daniel (1988, 1995b).

PHENOLOGY.— Flowering: March; fruiting: March.

HABITAT.— Unknown; elevation unknown.

Department undetermined: *Bernoulli & Cario 2042* (K, MO).

Gibson (1974) did not note the occurrence of this species in Guatemala, but it was included from the country by Daniel (1988). The locality of Bernoulli and Cario's collection was illegibly written on the specimen label as either "Guaumitul" or "Guarunthal." Parker (2008:13) indicated that the species is "probably found in the Petén." Because of the general occurrence of *B. integerrima* along the Pacific coast in Central America, it is more likely that it occurs (or formerly occurred) in southern Guatemala, near the Pacific coast. The species, though possibly extirpated in Guatemala, is widespread and locally abundant in other regions of Mexico and Central America, where it occurs in lowland swamps, leeward margins of mangrove communities, and palm forests at elevations below 300 meters.

***Carlowrightia arizonica* A. Gray**

RECENT DESCRIPTIONS.— Daniel (1983, 1995b, 1997b).

PHENOLOGY.— Flowering: January–March, October; fruiting: January–March, October.

HABITATS.— Tropical deciduous forest, moist thickets, along arroyos, disturbed sites; 180–400 m.

Chiquimula: *Standley 74521* (F, NY, US). **El Progreso**: *Daniel et al. 11215* (BIGU, CAS, K, MO). **Zacapa**: *Kellerman 7947* (F).

Gibson (1974) treated this species as *C. costaricana* Leonard, a taxonomic synonym (see Daniel 1983). *Carlowrightia arizonica* is represented by diverse forms throughout its broad range (Daniel 1983, 1995b, 1997b). Plants from Guatemala have inflorescences consisting of elongate and ± weak spikes, dichasia that are alternate and ± secund, and rachises that are ± evenly pubescent with the pubescence mostly or entirely eglandular and varying from puberulent (trichomes erect to retrorse and up to 0.1 mm long) to ± hirsute (with overstory trichomes flexuose to retrorse and up to 0.3 mm long). Although uncommonly collected in Guatemala, the species is locally abundant in dry regions of the country.

***Chileranthemum pyramidatum* (Lindau) T.F. Daniel**

Recent Description.— Daniel (1995b).

Phenology.— Flowering: January, August–October; fruiting: December.

Habitats.— Dry forests, brushy and rocky slopes; 500–1060 m.

Huehuetenango: *Seler & Seler 3276* (holotype of *Trybliocalyx pyramidatus* Lindau: B, destroyed). **Zacapa:** *Standley 73793* (holotype of *Clerodendrum standleyi* Moldenke: NY; isotype: F).

Gibson (1974) treated this species as *Trybliocalyx pyramidatus*, a nomenclatural synonym, and *T. albicaulis* (Brandegee) D.N. Gibson, a taxonomic synonym (see Daniel 1995a). Although the species has been collected only sporadically in Guatemala, it was collected as recently as 2008 in Huehuetenango (e.g., *Véliz and Velásquez 19326* at BIGU). Habitat data for Guatemalan plants is not well documented. In Chiapas, this species occurs in pine-oak forests at higher elevations, and elsewhere in Mexico (e.g., Oaxaca), it is known from arid regions at lower elevations.

***Dicliptera antidysenterica* A. Molina R., Ceiba 11:65. 1965. Type.**— HONDURAS. **Santa Bárbara**: eastern forested slopes of Cerro Sta. Bárbara, 2100 m, 4 April 1951, *P. Allen et al. 6056* (see discussion).

Perennials. Young stems subhexagonal to subquadrate-rounded to ± flattened, pubescent with mostly retrorse to retrorsely appressed eglandular trichomes 0.1–0.3 mm long, trichomes concentrated in (or ± restricted to) 2 vertical lines. Leaves petiolate, petioles to 72 mm long, blades ovate-elliptic to elliptic, 40–157 mm long, 20–73 mm wide, 2–2.1 times longer than wide, acuminate at apex, subattenuate at base, surfaces pubescent (especially on major veins) with flexuose to antrorse eglandular trichomes. Inflorescence of pedunculate cymes clustered in axils of leaves (especially distal leaves), collectively forming a ± dense thyrsoid unit to 65 mm long and to 30 mm in diameter near midpoint, rachis of thyrsoid unit pubescent like young stems (or with denser trichomes); cymes 1–4 per axil, opposite at nodes, peduncles to 12 mm long (those in an axil sometimes fused for several mm proximally), pubescent like young stems; paired bracts subtending cymes lanceolate, 4.5–11 mm long, 1.2–2.5 mm wide, abaxial surface sparsely pubescent with antrorsely appressed eglandular trichomes to 0.2 mm long to nearly glabrous, margin ciliate with sparse flexuose eglandular trichomes to 1 mm long; cymules 3–7 per cyme, subsessile (i.e., with peduncles to 1 mm long). Outer cymule bracteoles elliptic (smaller of the pair) to obovate (larger of the pair), those of a pair subequal to unequal in size, 7–12.5 mm long (the longer one 1.3–1.7 times longer than the shorter one), 1.8–4.5 mm wide, acute and apiculate at apex with apiculum (sometimes with an inconspicuous mucro) to 0.3 mm long, abaxial surface ± inconspicuously pubescent with antrorsely appressed eglandular trichomes 0.1–0.3 mm long, adaxial surface pubescent with antrorse eglandular trichomes (and sometimes with inconspicuous glandular trichomes to 0.2 mm long), margin ciliate with conspicuous flexuose eglandular trichomes 0.3–1 mm long. Inner cymule bracteoles lanceolate to lance-elliptic, 6–6.5 mm long, 1–1.3 mm wide, pubescent like outer cymule bracteoles. Flowers sessile. Calyx 4–4.3 mm long, lobes lance-subulate, 3–3.3 mm long, abaxially pubescent like outer cymule bracteoles. Corolla resupinate 180°, cream white with faint maroon markings on lip in posterior position (based on Honduran collections), 14–20 mm long, externally pubescent with flexuose eglandular and glandular (sometimes very sparse) trichomes 0.2–0.7 mm long, tube 6–8 mm long, 1.5–1.8 mm in diameter near midpoint, lips 7.5–12 mm long. Stamens 10–11.5 mm long, filaments pubescent with eglandular trichomes, thecae dehiscing toward upper lip, 1.3–1.5 mm long, subequal in size (distal one slightly longer), subparallel, unequally inserted but overlapping. Style 15–16 mm long, pubescent (at least proximally) with

eglandular trichomes, stigma lobes equal, 0.5 mm long. Capsules (based on Honduran collections) 6.5–7.5 mm long, pubescent with flexuose glandular (especially near apex) and eglandular trichomes 0.1–0.5 mm long.

Phenology.— Flowering: May; fruiting: unknown.

Habitat.— Unknown; 350 m.

Alta Verapaz: *von Tuerckheim 8256* (CAS, MO, NY, US).

In the protologue *Allen et al. 6056* at F is cited as the holotype and a duplicate at EAP is cited as an isotype. No collection with this number has been located at these (or other) herbaria. *Allen et al. 6054*, collected at the same time and place, was also listed (i.e., a paratype) in the protologue. All collections I have seen (EAP, F, US) are numbered 6054 and the collection at EAP bears Molina's annotation as "tipo". *Allen et al. 6054* at F was annotated as a "cotype" by Molina. Thus, either *Allen et al. 6056* has been lost or destroyed, and a neotype might be designated, or citation of *Allen et al. 6056* in the protologue was erroneous and *Allen et al. 6054* was intended as the type.

The inflorescences contain no true stipitate glandular trichomes (except on adaxial surface of cymule bracteoles); some of the eglandular trichomes have dark colored septae or bulbous bases that can superficially appear as glandular trichomes but they are not gland-tipped trichomes.

Gibson (1974) treated this species and the Guatemalan plants as *D. sumichrasti* Lindau, a species described from Veracruz, Mexico. Although in many characteristics the type of that species resembles Guatemalan plants, the latter more closely resemble *D. antidysenterica* from Honduras. Daniel (2005) noted distinctions between *D. sumichrasti* and *D. antidysenterica*. The description above pertains only to Guatemalan plants (except as noted), which greatly resemble those from Honduras. The species is either rare or possibly extirpated in Guatemala, it is known from several regions of Honduras where it occurs along streams and trails in moist forests.

Although Guatemalan species of *Dicliptera* are imperfectly known, they can be distinguished by the following key:

1. Outer cymule bracteoles ovate to deltate ..... *D. inutilis*
1. Outer cymule bracteoles neither ovate nor deltate.
    2. Corolla 12–20 mm long.
        3. Cymules pedunculate, peduncles (7-) 10–38 mm long; outer cymule bracteoles elliptic to circular, those of a pair equal in size; corolla externally pubescent with eglandular trichomes only; capsule glabrous ..... *D. thlaspioides*
        3. Cymules sessile to subsessile, peduncles (if present) to 2 mm long; outer cymule bracteoles elliptic to obovate to oblanceolate to spatulate, those of a pair equal to unequal in size; corolla externally pubescent with eglandular and glandular trichomes; capsule pubescent.
            4. Cymes alternate (i.e., in only one axil per node); outer cymule bracteoles equal to subequal in size (one 1–1.3 × longer than the other); calyx 5.2–7 mm long ..... *D. membranacea*
            4. Cymes opposite (i.e., in both axils per node); outer cymule bracteoles subequal to unequal (one 1.3–1.7 × longer than the other); calyx 1.7–4.3 mm long.
                5. Inner cymule bracteoles lanceolate to lance-elliptic, 6–6.5 mm long; calyx 4–4.3 mm long; corolla white with maroon markings; thecae 1.3–1.5 mm long; capsule 6.5–7.5 mm long ..... *D. antidysenterica*
                5. Inner cymule bracteoles lance-subulate, 2–4 mm long; calyx 1.7–3 mm long; corolla rose-pink with white markings; thecae 0.8–1.3 mm long; capsule 3–4.8 mm long ..... *D. unguiculata*

2. Corolla 24–36 mm long.
   6. Inflorescence usually of ± spikelike axes (or panicles of ± spikelike axes) bearing alternate (i.e., in only one axil per node), secund, and sessile to subsessile cymes bearing a single sessile to subsessile cymule; inner cymule bracteoles 3—5 mm long; calyx 2.5–3.2 mm long; corolla externally pubescent with eglandular trichomes; thecae 1.8–2.7 mm long ..... *D. sexangularis*
   6. Inflorescence otherwise, cymes (alternate or) opposite at nodes, sessile to pedunculate, and usually bearing 3 or more sessile to pedunculate cymules; inner cymule bracteoles 6–13 mm long; calyx 5–9 mm long; corolla externally pubescent with eglandular and usually glandular trichomes; thecae 1–1.8 mm long.
      7. Cymules pedunculate, peduncles 5–73 mm long; corolla red or orangish; capsule 9–11 mm long ..... *D. sciadephora*
      7. Cymules sessile to subsessile, peduncles (if present) to 2 mm long; corolla pale red, pink-red, or salmon-colored; capsule 5–9 mm long.
         8. Young stems ± 2-fariously pubescent; calyx 6–8 mm long; capsule 7.5–9 mm long, pubescent with glandular trichomes ..... *D. debilis*
         8. Young stems ± evenly pubescent; calyx 8–8.5 mm long; capsule 5–5.5 mm long, pubescent with eglandular and glandular trichomes ..... *D. guttata*

Dicliptera debilis **Leonard, J. Wash. Acad. Sci. 31:99. 1941.** TYPE.— GUATEMALA. **Baja Verapaz**: dry rocky hills N of Sta. Rosa in forest of pine and oak, 30 Mar 1939, *P. Standley 69823* (holotype: F!; isotype: US!).

Perennial herbs to 1.2 m tall. Young stems hexagonal, ± 2-fariously pubescent with erect to flexuose to retrorse eglandular trichomes 0.2–0.7 mm long. Leaves petiolate, petioles to 10 mm long, blades ovate, 18–48 mm long, 6–23 mm wide, 2.2–3 times longer than wide, acute to subacuminate at apex, acute to subattenuate at base, surfaces sparsely pubescent especially along midvein with eglandular and mostly antrorse trichomes. Inflorescence of cymes of cymules in leaf axils or terminating shoots; cymes 1–2 per axil, opposite at nodes, subsessile to pedunculate, peduncles of axillary cymes 1–10 (-16) mm long, ± evenly to 2-fariously pubescent with cauline type trichomes; paired bracts subtending cymes triangular-lanceolate to ovate to elliptic to obovate, 2.5–5.5 mm long, 1.5–2 mm wide, apex ± constricted-caudate, abaxial surface and margin pubescent with cauline type trichomes; cymules 3–4 per cyme, subsessile, peduncles to 2 mm long. Outer cymule bracteoles oblanceolate to obovate to elliptic, those of a pair subequal to unequal in size, 7–17 mm long (the longer one 1.2–1.9 times longer than the shorter one), 1.5–6.5 mm wide, rounded and ± apiculate at apex with apiculum to 0.4 mm long, abaxial surface and margin pubescent with flexuose to antrorse eglandular trichomes 0.2–0.4 mm long and usually with erect to flexuose subglandular to glandular trichomes 0.05–0.1 mm long (sometimes sparse and especially evident on margin) as well. Inner cymule bracteoles linear-lanceolate, 6–9 mm long, 0.7–1 mm wide, abaxial surface puberulent with erect subglandular to glandular and eglandular trichomes less than 0.1 mm long. Flowers sessile. Calyx 6–8 mm long, lobes lance-subulate, 4.5–7 mm long, abaxially pubescent like inner cymule bracteoles. Corolla resupination unknown, pale red, 27–32 mm long, externally pubescent with erect to flexuose glandular and eglandular trichomes 0.05-0.3 mm long, tube 18–21 mm long, 1.5–2.2 mm in diameter near midpoint, upper lip 8-11 mm long, lower lip 7-11 mm long, 3-lobed, lobes 0.4-0.5 mm long, 0.2-0.5 mm wide. Stamens 15 mm long, thecae with direction of dehiscence unknown, 1–1.2 mm long, subequal in size, parallel, unequally inserted to ± superposed (contiguous). Style 25 mm long, sparsely pubescent with eglandular trichomes, stigma

subcapitate. Capsule 7.5–9 mm long, pubescent with erect to flexuose glandular trichomes 0.1–0.2 mm long. Seeds sublenticular, 2–2.5 mm long, 1.7–2 mm wide, surfaces ± roughened or ridged, lacking trichomes.

PHENOLOGY.— Flowering: March; fruiting: March.

HABITAT.— Pine-oak forests, dry and rocky hills; elevation ca. 1500 m.

Baja Verapaz: *P. Standley 69823* (type, see above).

This poorly known and characterized species is endemic to Guatemala (Baja Verapaz), where it either rare or extinct. It is known only from the type, which was collected 70 years ago, and another collection from the same general region obtained two years later (rocky hills near and above Santa Rosa, pine-oak forest, ca. 1500 m, 4 Apr 1941, *Standley 91106* at F). Leonard (1941) provided an illustration of *D. debilis* in the protologue.

Dicliptera guttata **Standl. & Leonard in P.C. Standley and J.A. Steyermark, Publ. Field Mus. Nat. Hist., Bot. 23:239. 1947.** TYPE.— GUATEMALA. **Zacapa**: Sierra de las Minas, along Rillito de Volcán de Monos, Volcán de Monos, 1150–2100 m, 10 Jan 1942, *J. Steyermark 42396* (holotype: US! isotype: F! GH).

Shrubs to 1.5 m tall. Young stems quadrate-sulcate to hexagonal, ± evenly pubescent with flexuose to retrorse eglandular trichomes 0.2–1 mm long. Leaves petiolate, petioles to 50 mm long, blades ovate to ovate-elliptic, 30–108 mm long, 11–48 mm wide, 1.8–3.6 times longer than wide, acute to acuminate at apex, (rounded to) acute to subattenuate at base, surfaces pubescent with flexuose to antrorse eglandular trichomes. Inflorescence of cymes of cymules in axils of distal leaves; cymes 1 (–2) per axil, alternate or opposite at nodes, sessile (distally) to pedunculate (proximally), peduncles (if present) to 33 mm long; paired bracts subtending cymes often recurved (especially distally), lance-subulate to linear to oblanceolate or sometimes subfoliose to foliose (proximally), 4–14 (–55) mm long, 0.8—4 (–17) mm wide, abaxial surface pubescent with flexuose to antrorse eglandular trichomes, margin ciliate with flexuouse eglandular trichomes to 0.5 mm long; cymules usually 3 per cyme, sessile. Outer cymule bracteoles tinged reddish distally, elliptic to obovate, those of a pair unequal in size, 9–19 mm long (the longer one 1.4–1.7 times longer than the shorter one), 3–12 mm wide, acute to rounded and submucronate to apiculate at apex with apiculum/mucro to 0.2 mm long, abaxial surface pubescent with erect to antrorse eglandular trichomes 0.2–0.9 mm long and sometimes with an inconspicuous understory of erect glandular trichomes 0.05–0.2 mm long (especially at or near apex), adaxial surface similarly pubescent except glands sometimes more conspicuous, margin ciliate with conspicuous erect to flexuose eglandular trichomes to 1.8 mm long (and sometimes with glands like those of surfaces). Inner cymule bracteoles linear-lanceolate to lanceolate, 6–10 mm long, 0.5–1.2 mm wide, pubescent like outer cymule bracteoles. Flowers sessile. Calyx 8–8.5 mm long, lobes lance-subulate, 6–7.5 mm long, abaxially pubescent like inner cymule bracteoles. Corolla not resupinate, pale pink-red or salmon colored, 24–34 mm long, externally pubescent with erect to flexuose eglandular and glandular trichomes 0.1–0.4 mm long, tube 16–23 mm long, 2.2–3 mm in diameter near midpoint, upper lip 7.5–12 mm long, lower lip 8–14.5 mm long, 3-lobed, lobes 0.1–0.2 mm long, 0.3–0.5 mm wide. Stamens 17–21 mm long, inserted near midpoint of corolla tube, filaments sparsely pubescent with eglandular trichomes, thecae dehiscing toward lower lip, 1–1.5 mm long, subequal to equal in size, subparallel to perpendicular, superposed (contiguous or with a gap 0.1–0.4 mm). Style 25–36 mm long, sparsely pubescent proximally with eglandular trichomes, stigma 0.1–0.2 mm long. Capsules 5–5.5 mm long, pubescent with flexuose to retrorse eglandular and glandular trichomes 0.2–0.6 mm long. Seeds not seen.

Phenology.— Flowering: January; fruiting: January.

Habitat.— Oak-pine forests, moist draws; 1330 m.

Zacapa: *Daniel et al. 11226* (BIGU, BR, CAS, F, K, MICH, MO, US).

Dicliptera guttata is endemic to Guatemala (Zacapa), and Standley and Steyermark (1947) provided an illustration of it in the protologue. Prior to this study, it was known only from the type collection. During field-work in 2009 the species was rediscovered in the Sierra de las Minas, possibly at or near the type locality. *Daniel et al. 11226* was seen only at an elevation of 1330 meters where about 10 plants were encountered. Flowers of plants in this population were actively visited by hummingbirds. The Sierra de las Minas is well known for richness and endemism of plant species; about 2000 species have been recorded from the range, and at least 70 of them are endemic there (Dix 1997). The locale of *Daniel et al. 11226* appears to be within the boundaries of the Reserva de Biosfera Sierra de las Minas. At the present time, this species should be considered as rare.

***Dicliptera inutilis* Leonard, J. Wash. Acad. Sci. 31:101. 1941. Type.**— GUATEMALA. **Jutiapa**: Los Llanitos near San José Acatempa, ca. 1200 m, 21 Dec 1930, *P. Standley 60579* (holotype: F!).

Perennial herbs to 1.2 m tall. Young stems hexagonal, ± evenly pubescent with flexuose to antrorse to retrorse eglandular trichomes 0.1–0.3 mm long. Leaves petiolate, petioles to 14 mm long, blades ovate, 22–57 mm long, 8–24 mm wide, 1.8–2.8 times longer than wide, acuminate at apex, acute to subattenuate at base, sparsely pubescent with eglandular trichomes to nearly glabrous. Inflorescence of cymes of cymules in leaf axils; cymes 1 per axil, alternate or opposite at nodes, pedunculate, peduncles 1–2.5 mm long; paired bracts subtending cymes ± recurved, linear to obovate to oblanceolate, 2–9 mm long, 0.3–2.5 mm wide, abaxial surface sparsely pubescent with antrorse eglandular trichomes, margin sparsely ciliate (if at all) with erect eglandular trichomes to 0.1 mm long; cymules 2–3 per cyme, pedunculate, peduncles 1.5–3 mm long. Outer cymule bracteoles ovate to deltate, those of a pair subequal to unequal in size, 10–24 mm long (larger one 1.1–1.3–1.4 × longer than shorter one), 6–16 mm wide, rounded to acute and submucronate at apex, abaxial surfaces pubescent with antrorse eglandular trichomes 0.05–0.1–0.3 mm long and usually inconspicuously puberulent with inconspicuous erect glandular trichomes to 0.05 mm long, margin inconspicuously ciliate with antrorse eglandular trichomes to 0.2 mm long. Inner cymule bracteoles lance-linear, 2.5–4–5–5.2 mm long, 0.5–1 mm wide, abaxial surface pubescent like outer bracteoles except with glandular trichomes more conspicuous. Flowers sessile. Calyx 5.2–5.7 mm long, lobes lance-subulate to lanceolate, 3–4 mm long, abaxially pubescent like inner cymule bracteoles. Corolla (not seen at maturity) "rose-purple," buds externally pubescent with erect to flexuose eglandular trichomes 0.1–0.3–0.4 mm long and sometimes with erect glandular trichomes to 0.1 mm long as well. Staminal filaments pubescent with eglandular trichomes, thecae 1–1.1 mm long, equal in size, parallel to subparallel, superposed (contiguous). Style sparsely pubescent with eglandular trichomes, stigma lobes 0.2 mm long. Capsules (immature) 5 mm long, pubescent with erect to flexuose to retrorse eglandular trichomes 0.1–0.4 mm long. Seeds not seen.

Phenology.— Flowering: December–February; fruiting: February.

Habitat.— Moist thickets; ca. 1200 m.

Jutiapa: *Standley 60579* (type, see above). **Retalhuleu**: Champerico, *Johnston 1739* (F).

This is one of several Guatemalan species of *Dicliptera* that are known from limited materials and are poorly characterized. Presumably, *Johnston 1739* represents the same taxon as the type, but based on the condition of each collection this is not certain. These plants were collected in dif-

ferent regions of the country and there are some minor differences between them (e.g., outer cymule bracteoles subequal in size and acute at apex on type vs. unequal in size and rounded-submucronate at apex on *Johnston 1739*). Both are included in the description above.

Dicliptera inutilis is nearly endemic to Guatemala (Jutiapa and Retalhuleu), where it remains poorly known and collected. A collection from Belize was referred to the species by Daniel (1997a). Leonard (1941) provided an illustration of it in the protologue. Numerous collections from coastal western Mexico have been identified with this name; however, recent studies (Daniel 2009) reveal that the Mexican plants represent a distinct species, *D. novogaliciana* T.F. Daniel.

Dicliptera membranacea **Leonard, J. Wash. Acad. Sci. 31:102. 1941.** TYPE.— GUATEMALA. **Escuintla**: between Río Jute and Río Pantaleón on road between Escuintla and Santa Lucía Cotz, 540–720 m, 24 Jan 1939, *P. Standley 63524* (holotype: US! isotype: F!).

Perennial herbs to 1 m tall. Young stems quadrate-sulcate to hexagonal, subglabrous to ± bifariously pubescent with flexuose to retrorse to retrorsely appressed eglandular trichomes 0.1–0.3 mm long, trichomes concentrated near nodes. Leaves petiolate, petioles to 56 mm long, blades ovate to ovate-elliptic, 37–115 mm long, 15–68 mm wide, 2.5–2.9 times longer than wide, acute to acuminate at apex, acute to subattenuate at base, surfaces subglabrous or with antrorse eglandular trichomes mostly restricted to major veins. Inflorescence of cymes of cymules in axils of distal leaves and/or leaflike bracts sometimes forming a ± dense and terminal compound inflorescence, inflorescence bracts (if present) sessile to short-petiolate, ovate to lance-ovate, 14–22 mm long, 4–6 mm wide, inflorescence rachis (if present) ± evenly pubescent with retrorse eglandular trichomes; cymes 1–4 per axil, alternate (i.e., in only 1 axil per node), subsessile to pedunculate, peduncles 0.5–3 (–5) mm long; paired bracts subtending cymes elliptic to obovate-elliptic, 7–16 mm long, 3.2–6 mm wide, acute to acuminate and sometimes subfalcate at apex, emucronate to submucronate, abaxial surface sparsely pubescent with antrorse eglandular trichomes 0.1–0.3 mm long, margin ciliate with erect to flexuose to antrorse eglandular trichomes 0.2-0.8 mm long; cymules 3–5 (–6) per cyme, sessile to subsessile, peduncles to 2 mm long. Outer cymule bracteoles often whitish, obovate, those of a pair equal to subequal in size, 7.5–13.5 mm long (the longer one 1–1.3 times longer than the shorter one), 2.2–5 mm wide, acute to rounded-apiculate and ± mucronate at apex, mucro to 0.2 mm long, abaxial surface sparsely pubescent with antrorse eglandular trichomes 0.05–0.3 mm long, adaxial surface pubescence including an understory of erect glandular trichomes to 0.05 mm long (glandular puberulent), margin ciliate with erect to flexuose trichomes to 1 mm long. Inner cymule bracteoles often whitish, linear to lanceolate, 4–10 mm long, 0.3–1.1 mm wide, abaxial surface pubescent like outer cymule bracteoles. Flowers sessile to subsessile (pedicels to 0.5 mm long). Calyx 5.2–7 mm long, lobes subulate, 4–5.8 mm long, abaxially pubescent like outer cymule bracteoles and also glandular puberulent. Corolla resupination unknown, purplish, 13–14 mm long, externally pubescent with flexuose to retrorse eglandular trichomes 0.2–0.5 mm long and glandular puberulent, tube 6.5 mm long, 1 mm in diameter near midpoint, lips 6–6.5 mm long. Stamens 7 mm long, filaments sparesly pubescent with eglandular trichomes, thecae with direction of dehiscence unknown, 0.8–0.9 mm long, ± equal in size, parallel to subperpendicular, unequally inserted to superposed (contiguous). Style 10 mm long, pubescent with eglandular trichomes (at least proximally), stigma lobes ± equal, 0.2 mm long. Capsule 5.2–6 mm long, pubescent with erect to flexuose eglandular trichomes 0.2–0.3 mm long and glandular puberulent. Seeds 2.5–2.6 mm long, 2.2–2.4 mm wide, surfaces and margin covered with trichome-like papillae bearing barbs.

PHENOLOGY.— Flowering: January–March; fruiting: January–March.

HABITATS.— Wet forests, wet thickets, along streams, slopes; 600–720 m.

Escuintla: *Standley 63524* (type, see above); same locale as type: *Standley 63515* (F, US); NE of Escuintla, barranco of Río Burrión, *Standley 89590* (F, US). **San Marcos**: Río Mopá, below Rodeo, *Standley 68775* (F, US).

This species is variable in its morphology based on the known specimens from Mexico and Guatemala that have been attributed to it. For this reason, and lacking a taxonomic treatment of the genus for Mexico and Central America, the description above is based solely on the type and other collections from Guatemala that resemble it as cited above. A collection from Alta Verapaz (between Santa Cruz and Tactic, 1375 m, 14 April 1941-frt, *Standley 92268* at F and US) was annotated by Gibson as *D. membranacea* in 1970. It generally resembles this species except that trichomes on the young stems are more generally disposed and 0.1-0.5 mm long, the rachis is evenly pubescent with flexuose eglandular trichomes to 0.5 mm long, the cymes are opposite at nodes, the outer cymule bracteoles are elliptic to strap-shaped, the calyx is 4–5 mm long, and the capsules (to 7 mm long) are pubescent with eglandular trichomes only. No corollas are evident on the specimens, and the taxonomic disposition of this collection must await further studies.

***Dicliptera sciadephora* Donn. Sm.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: December–February; fruiting: December–February.

HABITATS.— Moist evergreen forests, oak forests, moist to wet thickets, forest edges; 1350–2250 m.

Alta Verapaz: *von Tuerckheim II 2106* (US). **Chimaltenango**: *Johnston 1605* (F). **Huehuetenango:** *Nelson 3584* (holotype: US; isotoypes: GH, US). **Sacatepéquez**: *Daniel & Véliz 11208* (BIGU, BR, CAS, K, MICH, MO, US). **San Marcos:** *Steyermark 36861* (holotype of *D. vulcanica* Leonard: F; isotype: US).

Gibson (1974) noted the occurrence of *D. sciadephora* in Petén; all collections so identified by her from this department at F pertain to *D. sexangularis*.

***Dicliptera sexangularis* (L.) Juss.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: December–April; fruiting: December–May.

HABITATS.— Moist forests, secondary forests, tall forests, short forests, scrub forests, ramonales, moist thickets, forest edges, disturbed sites (e.g., roadsides); 50–1100 m.

LOCAL NAMES.— "Amor seco" (*Tejada 152*); "yerba fluxion" (*Cook & Martin 202*).

Alta Verapaz: *Standley 91772* (F, US). **Chiquimula**: *Molina R. & Molina 25397* (F). **El Progreso**: *Steyermark 43330* (F, US). **Huehuetenango**: *Castillo & Castillo 2729* (F). **Petén**: *Steyermark 46187* (F). **Retalhuleu**: *Standley 88314* (F, US). **Sololá**: *Artamanoff s.n.* (F). **Suchitepéquez**: *Kellerman 4977* (US). **Zacapa**: *Daniel et al. 11232* (BIGU, CAS, K, MICH, MO).

Gibson (1974) treated this species with the name *D. assurgens* (L.) Juss., a taxonomic synonym (see Daniel 1995b).

***Dicliptera thlaspioides* Nees**

RECENT DESCRIPTION.— Daniel (1999a).

PHENOLOGY.— Flowering: September–November; fruiting: September–November.

HABITAT.— Along streams; 900–980 m.

Huehuetenango: Cuilco, Aldea Canibal, Río Cuilco, 15°24'04.1"N, 92°03'35.1"W, *P. Velásquez & M. Véliz 441* (BIGU), *P. Velásquez et al. 442* (BIGU), *P. Velásquez et al. 476*

(BIGU); Mpio. Cuilco, Aldea Canibal, Transecto III, 15°24'17.1"N, 91°02'47.7"W, *M. Véliz et al. 17920* (BIGU).

This species is newly reported from Guatemala based on the four recent (2006–2007) collections noted above, all of which came from the same region in Huehuetenango. The species was previously known only from western and southern Mexico (Daniel 1999a, 2009), where it is sometimes locally abundant in tropical deciduous forests, oak forests, and disturbed sites.

***Dicliptera unguiculata* Nees**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: November–March; fruiting: November–May.

HABITATS.— Oak forests, pine-oak forests, wet or dry thickets, brushy slopes, disturbed sites (e.g., eucalyptus forests, roadsides); 915–2100 m.

LOCAL NAMES.— "Hierba de cáncer" (*Standley 64745*); "lavanda" (*Immerzell & Pardo 109*); "panalitos" (*Aguilar 6*).

LOCAL USE.— Leaves are used to alleviate "mal de orina, gastritis y inflamación" (*Immerzell & Pardo 109*).

Alta Verapaz: *Tejada s.n.* X 1913 (USCG). **Chimaltenango**: *Standley 80801* (F, US). **Guatemala**: *Standley 59543* (F, US). **Jalapa**: *Standley 77449* (F). **Quezaltenango**: *Standley 67245* (F). **Sacatepéquez**: *Standley 60899* (F, US). **Sololá:** *Daniel & Barreno 11264* (BIGU, CAS).

Pollen of this species (based on *Daniel & Barreno 11264*) differs from other Mexican and Guatemalan species of *Dicliptera* by its deeper reticulum with more conspicuous collumelae (Fig. 5).

***Dyschoriste capitata* (Oerst.) Kuntze**

RECENT DESCRIPTIONS.— Daniel (1995b, 1999a).

PHENOLOGY.— Flowering: June–September; fruiting: June–December.

HABITATS.— Mixed forests, pine forests, moist thickets, moist rocks along streams, disturbed sites (e.g., roadsides, pastures); 1500–2800 m.

LOCAL NAME.— "Lombricera" (*Molina R. & Molina 26537*).

Chimaltenango: *Skutch 474* (holotype of *D. skutchii* Leonard: US). **Huehuetenango**: *Steyermark 48202* (F, US). **Jalapa**: *Steyermark 33063* (F). **Quiché**: *Spuoss 138* (F).

Gibson (1974) treated this species with the name *D. skutchii*, a taxonomic synonym (see Daniel 1995b).

Daniel (2001) discussed the possible occurrence of *Dyschoriste hirsutissima* (Nees) Kuntze in Guatemala and provided descriptions of it (Daniel 1995b, 1999a; Daniel and Acosta C. 2003). It differs conspicuously from other species in the country by having glandular trichomes on various parts of the plant (e.g., stems, leaves, and/or calyx).

***Dyschoriste ovata* (Cav.) Kuntze**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: July–October; fruiting: August–October.

HABITAT.— Pine forests; 1400–2000 m.

LOCAL NAMES.— "Clarencillo" (*Steyermark 50483*), "madre selva" (*Barrientos s.n.*).

Chimaltenango: *Johnston 30* (F). **Guatemala**: *Tonduz 824* (US). **Huehuetenango**: *Steyermark 50483* (F, US).

Gibson (1974) noted that Loesener had reported this species from the department of Quezaltenango; she also noted that some of Loesener's other identifications of *Dyschoriste* from

Guatemala were likely erroneous. No collections of *Dyschoriste* from Quezaltenango were located, but it is likely that the genus occurs there.

***Dyschoriste quadrangularis* (Oerst.) Kuntze**

RECENT DESCRIPTIONS.— Daniel (1995b), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: October–January; fruiting: October–February.

HABITATS.— Moist oak forests, dry pine-oak forests, marshes, moist thickets, open slopes, brushy slopes; 850–1550 m.

LOCAL NAMES.— "Tucuquita" (*Molina R. & Molina 27687*); "tucuquita de agua" (*Standley 75275*).

Chimaltenango: *Standley 64358* (F). **Guatemala**: *Aguilar 282* (F). **Jalapa**: *Standley 77146* (F, US). **Jutiapa**: *Standley 75998* (F, US). **Sacatepéquez**: *Standley 63348* (F, US). **Santa Rosa**: *Standley 60453* (F).

***Elytraria bromoides* Oersted**

RECENT DESCRIPTIONS.— Daniel (1995b), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: April–June; fruiting: April.

HABITAT.— Unknown; 360 m.

Alta Verapaz: *von Tuerckheim 3586* (US). **Petén**: *Lundell 3708* (CAS, F, GH, MICH).

Elytraria bromoides is uncommon in Guatemala. It sometimes becomes locally abundant northward and westward toward the northern extent of its range in Texas. Outside of Guatemala, it occurs in diverse communities (often at disturbed sites), including arid scrub, tropical deciduous forests, oak forests, pine forests, and evergreen seasonal forests. It differs from the more common *E. imbricata* by its stemless habit, larger and pinkish (vs. blue) corollas (Fig. 2L, M), and entire (vs. apically 3-lobed) bracts.

***Elytraria imbricata* (Vahl) Pers.**

RECENT DESCRIPTIONS.— Daniel (1995b, 1997b, 1999a), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: October–May; fruiting: October–May.

HABITATS.— Tropical deciduous forests, low forests, ramonales, dry to moist thickets, brushy slopes, pastures, disturbed sites (e.g., roadsides, agricultural lands); 5–3000 m.

LOCAL NAMES.— "Cola mayci" (*Steyermark 29039*); "flor de mosquito" (*Standley 75545*); "hierba del cancer" (*Alvarez 24*).

Baja Verapaz: *Johnston 1162 (F)*. **Chiquimula**: *Molina R. & Molina 25381* (F). **El Progreso**: *Véliz & Ramirez 12782* (BIGU). **Escuintla**: *Standley 64161* (F). **Guatemala**: *Tejada 145* (US). **Huehuetenango**: *Standley 811425* (F). **Jutiapa**: *Standley 75545* (F). **Petén**: *Contreras 5619* (F, GH, MO). **Quetzaltenango**: *Rodríguez 98* (U). **Quiché**: *Véliz et al. 17776* (BIGU). **Retalhuleu**: *Kellerman 6663* (F, US). **Sacatepéquez**: *Standley 64964* (F). **San Marcos**: *Daniel et al. 11321* (BIGU, CAS, K, MO). **Santa Rosa**: *Standley 77826* (F). **Sololá**: *Pöll 13539* (UVAL). **Suchitepéquez**: *Standley 60253* (F). **Zacapa**: *Steyermark 29039* (F). **Department unknown**: Pacific lowlands, Finca Fielauer, *Brenckle 47–218* (UC).

Bracts of Guatemalan plants all show a ± prominent 3-parted apex, which is generally diagnostic for the species, except in immature inflorescences. Gibson (1974) reported this species from Alta Verapaz and Chimaltenango, but no collections from those departments were located.

***Henrya insularis* Nees ex Benth.**

RECENT DESCRIPTIONS.— Daniel (1990a, 1995b, 1997b, 1999a), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: January–April; fruiting: February–April.

HABITATS.— Tropical deciduous forest-oak forest transitions, tropical subdeciduous forests, dry thickets, dry and brushy slopes and plains, along streams; 120–1300 m.

LOCAL NAME.— "Tiramachete" (*Morales R. 911*).

Chimaltenango: *Johnston 1160* (F). **El Progreso:** *Daniel et al. 11211* (BIGU, CAS, K, MICH, MO). **Guatemala:** *Donnell Smith 1923* (holotype of *H. imbricans* Donn. Sm.: US; isotype: GH); *Morales R. 911* (holotype of *H. puberula* Happ: F; isotypes: AGUAT, US). **Huehuetenango**: *Véliz et al. 11203* (BIGU). **Retalhuleu**: *Standley 88432* (F, US). **Santa Rosa**: *Heyde & Lux 4559* (holotype of *H. donnell-smithii* Happ: MO; isotypes: GH, US). **Sololá**: *Artamanoff s.n.* (F). **Zacapa**: *Deam 397* (holotype of *Tetramemrium gualanense* Robins. & Bartl.: GH; isotype: MICH).

Gibson (1974) recognized *Henrya gualanensis*, *H. imbricans*, *H. puberula*, and *H. scorpioides* Nees. The type of the latter name pertains to *Dicliptera sexangularis* (see Daniel 1990a:130); the other three species were treated as conspecific with *H. insularis* by Daniel (1990a).

***Hygrophila costata* Nees**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: September–May; fruiting: September–May.

HABITATS.— Wet thickets, marshes, along streams, ditches, depressions; 150–1400 m.

Alta Verapaz: *Standley 70984* (F, US). **Chiquimula**: *Molina R. & Molina 25255* (F). **Escuintla**: *Standley 63454* (F, US). **Izabal**: *Standley 23803* (US). **Quezaltenango**: *Skutch 2032* (US). **Quiché**: *Aguilar 1501* (F). **Retalhuleu**: *Steyermark 34533* (F). **San Marcos**: *Standley 68877* (F). **Suchitepéquez**: *Standley 67010* (F).

Gibson (1974) recognized both *H. costata* and *H. guianensis* Nees from Guatemala. These were treated as conspecific by Daniel (1995b).

***Hypoestes phyllostachya* Baker**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: November–February; fruiting: November–February.

HABITATS.— Disturbed sites; 1000–1500 m.

Alta Verapaz: *Daniel et al. 11362* (CAS). **Baja Verapaz**: *Daniel & Véliz 11331* (BIGU, CAS). **Escuintla:** *Vizcaíno 6156* (UVAL). **Guatemala**: *J. Castillo & L. Cruz 2325* (F). **Sacatepéquez:** *Véliz 12651* (BIGU). **San Marcos**: *R. Barillas s.n.* (BIGU, MO).

This commonly cultivated and often escaping species was not noted to occur in Guatemala by Gibson (1974). It is endemic to Madagascar. The collections noted above represent (e.g., *Daniel & Véliz 11331*, *Daniel et al. 11362*) or appear to represent (other collections noted) naturalized occurrences. Occurrences in other departments were noted to be from cultivated plants.

***Justicia albobractea* Leonard**

RECENT DESCRIPTION.— Daniel (1993b).

PHENOLOGY.— Flowering: November–February; fruiting: February–March.

HABITATS.— Tropical moist forests, tall forests, along streams; ca. 300–700 m.

Petén: *Contreras 9356* (F, LL, MO, US).

The species is known from at least six collections from Petén and Belize. It was not treated from Guatemala by Gibson (1974), but was noted to occur in the country by Daniel (1993b). *Steyermark 41998* (F, US) from Izabal is a barely fertile, fruiting collection that might also pertain to

this species. *Justicia albobractea* is superficially similar to the Costa Rican *J. sarapiquensis* McDade, which differs by its climbing habit (vs. shrub), ovate (vs. narrowly eliptic to narrowly obovate-elliptic) and glabrous (vs. pubescent) leaf blades, terminal panicles (vs. axillary spikes), magenta (vs. greenish white) bracts that are 14–16 (vs. 4.5–9.5) mm wide, calyx lobes 15–22 (vs. 4.5–5.5) mm long, corollas 65–70 (vs. 29–31) mm long, anther thecae 4 (vs. 1.6–2) mm long, glabrous (vs. pubescent near apex) capsules 15–20 (vs. 9.5–10.5) mm long, and glabrous (vs. pubescent) seeds 3–4 (vs. 1.8–2.4) mm in diameter.

***Justicia aurea* Schlecht.**

RECENT DESCRIPTIONS.— Daniel (1995b), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: August–April; fruiting: December–February.

HABITATS.— Moist to wet forests, forest remnants with *Chiranthrodendron*, cloud forests of mixed hardwoods, tall forests, dry forests, moist thickets, along streams, swampy depressions, disturbed sites (e.g., hedgerows); (245-) 950–2500 m.

LOCAL NAMES.— "Plumero" (*Standley 64743*); "pompóm" (*Standley 64743*).

Alta Verapaz: *von Tuerckheim II–200A* (F, MO, US). **Chimaltenango**: *Standley 60051* (F). **Chiquimula**: *Steyermark 31700* (F). **Escuintla**: *Standley 64594* (F). **Guatemala**: *Donnell-Smith 1877* (US). **Huehuetenango**: *Véliz & Velásquez 19362* (BIGU). **Izabal**: *Kellerman 6684* (F). **Petén**: *Tún Ortíz 2057* (DUKE, F, MO, US). **Quezaltenango:** *Hartweg 552* (holotype of *Justicia umbrosa* Benth.: K; isotypes: BM, K). **Quiché**: *Skutch 1852* (US). **Retalhuleu:** *Shannon 160* (US). **Sacatepéquez**: *Standley 88982* (F). **San Marcos**: *Williams et al. 26034* (F). **Santa Rosa**: *Steyermark 33146* (F). **Sololá**: *Kellerman 5827* (US). **Suchitepéquez**: *Skutch 1581* (F, US).

The type of the taxonomic synonym *Justicia velasquezii* Bertol. (as "vellasquezii;" *Velásquez s.n.* at BOLO, image!) was collected from an unknown locale in Guatemala.

This showy species is cultivated for ornament in some Guatemalan gardens. The large and abundant flowers are yellow and turn golden or orangish in age. They are sometimes noted to be visited by hummingbirds (e.g., *Nee et al. 47220*, MO). A red-flowered form of this species was described as *J. aurea* forma *erythrantha* (Standl. & Steyerm.) D.N. Gibson (based on *Jacobinia umbrosa* forma *erythrantha* Standl. & Steyerm.). Gibson (1974) incorrectly listed this taxon as forma "erythrina." Standley and Steyermark (1947) noted that the form, known only from the type (*Standley 60082*: holotype at F! isotype at US!) and a paratype (*Johnston 1108* at F!), both from Volcán de Acatenango, above Las Calderas in Chimaltenango, appears to differ from typical plants of the species only by its red corollas. Based these two collections, this indeed appears to be the case. Gibson (1974) referred *Laughlin 2565* from Chiapas to this taxon, but Daniel (1995b) indicated that this Mexican collection pertains to *J. soliana*.

***Justicia bartlettii* (Leonard) D.N. Gibson**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: December–April; fruiting: January–April.

HABITATS.— Lowland rain forests, tall forests, short forests, ramonales, zapotales, streamsides; 10–165 m.

Alta Verapaz: *Steyermark 45571* (F, MICH, US). **Izabal**: *Daniel et al. 11240* (BIGU, CAS, MO). **Petén:** *Tún Ortíz 1529* (holotype of *J. pilifera* D.N. Gibson: F; isotype: MO).

Gibson (1974) recognized *J. pilifera* as distinct from *J. bartlettii*. Daniel (1995b) treated them as conspecific. *Justicia eburnea* is superficially similar but generally glabrous (see distinctions under *J. eburnea* below).

***Justicia* borrerae (Hemsl.) T.F. Daniel**

Recent Description.— Daniel (1995b).

Phenology.— Flowering: March–November; fruiting: March, July.

Habitats.— Montane forests, thickets; 1200–2000 m.

Local names.— "Jasmín de montaña" (*White 5450*); "palma de monte" (*Steyermark 37219*).

Huehuetenango: *Sánchez 1678* (USCG). **San Marcos**: *Steyermark 37219* (F).

Gibson (1974) treated this species as *Neohallia borrerae* Hemsl. Daniel (1995a) treated *Neohallia* as congeneric with *Justicia*. Photos of this species at USCG reveal it to have orange corollas (with the lower lip ± coiled) and subtending bracts that are greenish with a reddish tinge. The species has been collected recently (e.g., 2009) on the lower slopes of Volcán Tajumulco in San Marcos (e.g., *Morales 564* at F and *Sirin 29* at BIGU). Information on *Morales 564* notes that plants were small trees to 10 m tall.

***Justicia breviflora* (Nees) Rusby**

Recent Description.— Daniel (1995b).

Phenology.— Flowering: January–September; fruiting: January–September.

Habitats.— Lowland rain forests, tall forests, mixed forests, moist to wet thickets, along streams, acahuales, ramonales, disturbed sites (e.g., agricultural lands, clearings); 0–1500 m.

Alta Verapaz: *Standley 90003* (F). **Baja Verapaz**: *Pittier 153* (US). **Chimaltenango**: *Johnston 1904* (F). **Huehuetenango**: *Steyermark 49388* (F, US). **Izabal:** *Blake 7800* (holotype of *Dianthera riparia* S.F. Blake: US). **Petén**: *Contreras 9754* (F, US). **San Marcos**: *Steyermark 37588* (F).

The type of *Pseuderanthemum tetrasepalum* (S.F. Blake) S.F. Blake, which was treated by Gibson (1974) from Guatemala, pertains to *J. breviflora* (Daniel 1997a). Gibson (1974) noted the variation in both color and size of the corollas encountered among Guatemalan plants of this species. *Daniel & Véliz 11259* from along a stream in Izabal, which accords well with the type of *D. riparia*, has white corollas suffused with patches and tinges of pink-purple and a pink-purple herringbone pattern on the proximal portion of the lower-central corolla lobe.

***Justicia campechiana* Standl.**

Recent descriptions.— Daniel (1995b, 2007).

Phenology.— Flowering: January, April; fruiting: January, April.

Habitats.— Tall forests, zapotales, ramonales; ca. 180–240 m.

Alta Verapaz: *Steyermark 45600* (F, MICH, MO, UC, US). **Petén**: *Contreras 5430* (DUKE, F, MO, US).

Steyermark 45600 from Alta Verapaz resembles plants from Chiapas by having the young stems evenly pubescent and the leaves, bracts, and calyx conspicuously pubescent. These plants were treated as subspecies *vestita* by Daniel (2007). Plants from the Petén of Guatemala, Belize, and the Yucátan Peninsula of Mexico have stems bifariously pubescent and the leaves, bracts, and calyx glabrous. The latter plants pertain to the nominate subspecies. In Guatemala subspecies *campechiana* occurs in evergreen seasonal forests at elevations to 240 m whereas subspecies *vestita* occurs in montane rain forests at elevations above 500 m.

***Justicia candelariae* (Oerst.) Leonard**

Recent Description.— Daniel (1995b).

Phenology.— Flowering: December–April; fruiting: February.

Habitats.— Moist to wet forests, montane forests, pine forests, moist to wet thickets, along streams; 250–1800 m.

Alta Verapaz: *von Tuerckheim 8726* (holotype of *J. tuerckheimiana* Donn. Sm.: US). **Quezaltenango**: *Skutch 2009* (F, US). **San Marcos**: *Standley 68945* (F, US). **Suchitepéquez**: *Standley 66861* (F).

Gibson (1974) tentatively recognized both *J. chiapensis* Brandegee and *J. tuerckheimiana*; these were treated as conspecific with *J. candelariae* by Daniel (1995b). She also noted the occurrence of the species from El Progreso. No specimens from that department were located during this study.

***Justicia carthagenensis* Jacq.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: August–March; fruiting: October–March.

HABITATS.— Oak woodland-pasture, moist to wet thickets, brushy slopes, in and along streams, disturbed sites (e.g., eucalyptus forests, hedges, roadsides, agricultural lands); 215–2200 m.

LOCAL NAMES.— "Capote azul" (*Morales R. 1092*); "hierba de tinta" (*Aguilar 27*); "sacatinta" (*Molina R. & Molina 27690*); "tinta cimarrona" (*Standley 88764*); "tinta silvestre" (*Morales R. 766*); "yerba de tinta" (*Steyermark 52161*).

Chimaltenango: *Seler & Seler 2288* (POM, US). **Chiquimula**: *Steyermark 30317* (F). **Escuintla**: *Aguilar 1687* (F). **Guatemala**: *Molina R. & Molina 27690* (F). **Jutiapa:** *Standley 75969* (holotype of *J. corynimorpha* D.N. Gibson: F; isotype: US). **Petén**: *Contreras 3481* (F, LL, MO, US). **Retalhuleu**: *Molina R. & Molina 27113* (F, MICH). **Sacatepéquez**: *Standley 63233* (F, US). **Santa Rosa**: *Standley 79531* (F, US). **Sololá**: *Molina R. 15276* (F). **Suchitepéquez**: *Standley 62101* (F, US). **Zacapa**: *Steyermark 42104* (F).

Gibson (1974) recognized *J. corynimorpha* as distinct from *J. carthagenensis*. Daniel (1995b) treated them as conspecific. Gibson (1974) noted the occurrence of the species in Baja Verapaz. No collections from that department were located during this study. The identity of some collections identified as this species (e.g., *Molina R. & A. Molina 26656* at MICH from Sololá) differ from others by their glabrous internodes, dense terminal headlike inflorescences to 5 cm in diameter, and exceptionally large (2.5–4.5 mm wide) and apically subcaudate calyx lobes. Until variation in this species from throughout its range is better documented, these collections are tentatively treated as *J. carthagenensis*.

***Justicia caudata* A. Gray**

RECENT DESCRIPTIONS.— Daniel (1995b), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: September–November; fruiting: October–January.

HABITAT.— Tropical deciduous forests, moist and brushy slopes, potreros, disturbed sites (e.g., roadsides); 300–575 m.

LOCAL NAME.— "Monteritas" (*Morales R. 1347*).

El Progreso: *Cóbar & Véliz 1057* (BIGU, MO). **Jalapa**: *Morales R. 1347* (F). **Zacapa**: *Standley 73995* (F, US).

Gibson (1974) noted the occurrence of this species in Retalhuleu. No collections from that department were located during this study.

***Justicia ciriloi* T.F. Daniel**

RECENT DESCRIPTION.— Daniel (2005).

PHENOLOGY.— Flowering: November; fruiting: November.

HABITAT.— Moist and shady slopes along streams; "600–1800" m.

Chiquimula: *Steyermark 31740* (holotype of *Beloperone blechioides* Leonard: F).

This species is known in Guatemala only from the type collection made in 1939 and is either rare or extirpated in the country. It has been collected at least three times more recently in Honduras (Daniel 2005). Daniel (2005) discussed the taxonomic history of *J. ciriloi*. Gibson (1974) included this taxon (as *B. blechioides*) and *J. brandegeana* Wassh. & L.B. Sm. within a broad concept of *J. fulvicoma* Schlecht. *Justicia brandegeana* is cultivated in Guatemala, and *J. fulvicoma* might be as well. The illustration provided by Gibson (1974), labeled as *J. fulvicoma*, pertains to *J. ciriloi*. These three species can be distinguished by the following key:

1. Corolla white to yellowish with reddish or maroon spots on lips; mature seeds minutely granulate (appearing ± smooth).
   2. Inflorescence erect; bracteoles linear-elliptic to elliptic, 1.4–3 mm wide ..... *J. ciriloi*
   2. Inflorescence drooping or nodding; bracteoles ovate to elliptic, 3–6.5 mm wide ..... *J. brandegeana*
1. Corolla orange with reddish spots on lips; mature seeds minutely granulate and also tuberculate with low, rounded to subconic mounds that are sometimes ± coalesced into chains or ridges ..... *J. fulvicoma*

***Justicia clinopodium* Gray ex Greenm.**

Recent Description.— Daniel (1995b).

Phenology.— Flowering: July–September; fruiting: August–September.

Habitat.— Moist thickets; 1350–2000 m.

Local name.— "Tucuquita" (*Molina R. & Molina 26318*).

Huehuetenango: *Steyermark 51782* (F, US).

Although rarely collected in Guatemala, this species is considerably more widespread and abundant in Mexico where it occurs in pine-oak forests at elevations from 1410 to 2400 meters.

***Justicia colorifera* V.A.W. Graham**

Recent Description.— Daniel (1995b).

Phenology.— Flowering: November–May; fruiting: unknown.

Habitats.— Tropical dry forests, along streams; 350–1300 m.

Local names.— "Jiquilite" (*Castillo & Castillo 2807*, *Sálas 663*); "saca tinta" (*Castillo & Castillo 2807*); "tinta" (*McCarry 152*; *Steyermark 33706*).

Local Uses.— Leaves used to bleach clothes and to cure "evil eye" (*McCarry 152*); used medicinally to treat urinary infections and diarrhea (*Castillo & Castillo 2807*); yields a blue dye (*Cook & Griggs 147*).

Alta Verapaz: *von Tuerckheim 8544* (US). **El Progreso**: *Fortuny s.n.* 25 XI 2005 (USCG). **Guatemala**: *Tejada s.n.* IV 1913 (USCG). **Huehuetenango**: *Castillo & Castillo 2807* (F). **Quezaltenango**: *Steyermark 33706* (F). **Sacatepéquez**: *McCarry 152* (TEX). **Santa Rosa**: *Heyde & Lux 4557* (F, MO, US).

This species was treated by Gibson (1974) under the name *J. tinctoria* (Hemsl.) D.N. Gibson, an illegitimate nomenclatural synonym (see Daniel 1995b). The species has been cultivated in parts of Mexico and Central America for the uses noted above. Although they were not noted to be so, some of the collections cited above likely represent cultivated plants. *Standley 69470* from Alta Verapaz (near Cobán, 1260–1440 m, 26 Mar–15 Apr 1939 at F) was noted to be common in gardens and hedges. It was also noted to have the local name, "jiquelite." It differs from most representatives of *J. colorifera* by having the young stems, peduncles, and rachises pubescent with flexuose

to retrorse eglandular trichomes to 2 mm long rather than glabrous; its corollas were noted to be pale red. This collection, together with a similar one from Baja Verapaz (Unión Barrios, W of KM 156 on the Cobán Road, tall forest on hill, 11 Apr 1975, *Lundell & Contreras 19164* at F, LL, and MO) that has similar pubescence and pink corollas, might comprise another (possibly undescribed) taxon. Neither of these collections is included here under *J. colorifera*.

***Justicia comata* (L.) Lam.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: September, December–May; fruiting: September–May.

HABITATS.— Moist forests, perennial forests subject to flooding, swamps, marshes, short forests, moist to wet thickets, clearings, along streams, disturbed sites (e.g., roadside ditches); 0–300 m.

Alta Verapaz: *von Tuerckheim 7653* (US). **Escuintla**: *Standley 64005* (US). **Izabal**: *Steyermark 39764* (F). **Petén**: *Molina R. 15634* (F). **San Marcos**: *Steyermark 38022* (F). **Santa Rosa**: *Standley 79578* (F, US).

Gibson (1974) reported the occurrence of this species in Retalhuleu. No specimens from that department were located during this study.

***Justicia eburnea* D.N. Gibson**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: March–May, August; fruiting: March–May, August.

HABITATS.— Tall forests, short forests, zapotales; 0–210 m.

Alta Verapaz: *Steyermark 45023* (F). **Izabal:** *Steyermark 39535* (holotype: F). **Petén**: *Steyermark 46109* (F, MICH, US).

Daniel's (1995b) key to and description of *J. eburnea* incorrectly indicates that it has five calyx lobes when, in fact, it has only four. The species can be distinguished from the superficially similar *J. bartlettii* by the following couplet:

Young stems, leaf surfaces, peduncles, and rachises glabrous; bracts triangular to subulate, 0.5–1.5 mm long, abaxially glabrous; bracteoles triangular, 0.5–1.3 mm long, abaxially glabrous; calyx 2.5–3.5 mm long, abaxially glabrous; corolla externally glabrous ..... *J. eburnea*

Young stems, leaf surfaces, peduncles, and rachises pubescent; bracts lance-subulate to lanceolate, 2–5 mm long, abaxially pubescent; bracteoles lance-subulate to lanceolate, 2–5 mm long, abaxially pubescent; calyx 6–12 mm long, abaxially pubescent; corolla externally pubescent ..... *J. bartlettii*

***Justicia fimbriata* (Nees) V.A.W. Graham**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: December–July; fruiting: December–April.

HABITATS.— Lowland rain forests, lowland moist evergreen forests, moist montane forests, tall forests, short forests, rocky hills, zapotales, disturbed sites (e.g., clearings); 0–1280 m.

Huehuetenango: *Holdridge 2332* (US). **Izabal**: *Daniel et al. 11235* (BIGU, CAS, K, MICH, MO). **Petén**: *Contreras 6622* (F, LL, MO, US). **Quiché**: *Morales & Pérez 4600* (USCG). **San Marcos**: *Steyermark 37548* (F).

Gibson (1974) treated this species with the name *J. magniflora* (Blake) D.N. Gibson, a taxonomic synonym (Daniel 1995b). She also noted its occurrence in Baja Verapaz (possibly based on *Watson 73* from "eastern portions of Vera Paz and Chiquimula").

***Justicia gibsoniae* S.S.R. Bennet & S. Chandra, J. Econ. Taxon. Bot. 3(2):602. 1982**, as "gibsonia." *Justicia grandifolia* D.N. Gibson, Fieldiana: Bot. 34:69. 1973, non T. Anders. (1867). TYPE.— GUATEMALA. **Izabal**: Cerro San Gil, 300–900 m, 25 Dec 1941, *J. Steyermark 42001* (holotype: F!; isotype: US!).

Monocaulous shrubs to 1.5 m tall. Young stems subquadrate-ridged, glabrous to ± scurfy. Leaves (upper) subsessile, petioles to 6 mm long, blades elliptic to obovate-elliptic, 245–330 mm long, 80–95 mm wide, 3.1–3.8 times longer than wide, acute to subacuminate at apex, attenuate at base, abaxial surface glabrous. Inflorescence of terminal panicles (of spikes) to 280 mm long (including peduncle and excluding flowers), peduncles to 60 mm long, peduncle and main rachis sparsely pubescent with retrorse to flexuose eglandular trichomes 0.1–0.2 mm long in 1 or more lines; inflorescence bracts (subtending dichasiate spikes) to 35 mm long, oblanceolate, 7–9.5 mm long, 1.5–2 mm wide; dichasia sessile, alternate along spikes, 1-flowered. Bracts apparently homomorphic (i.e., sterile bracts similar to fertile bracts), linear, 10 mm long, 1.6 mm wide, abaxial surface glabrous, margin with sparse flexuose eglandular trichomes to 0.6 mm long. Bracteoles lanceolate, 7.5 mm long, 1 mm wide, abaxial surface glabrous, margin pubescent like bracts. Calyx 5-lobed, 9.5 mm long, lobes lanceolate, 8.5 mm long, abaxial surface glabrous, margin pubescent like bracts. Corolla "pale yellow with greenish tip," 40–54 mm long, externally pubescent with erect to flexuose glandular and eglandular trichomes trichomes 0.05–0.8 mm long, tube 25–32 mm long, gradually expanded distally, not differentiated into narrow proximal portion and throat, 2.5–3 mm in diameter near midpoint, upper lip 15–22 mm long, 2-fid, lower lip sometimes ± recoiled, 15–20 mm long, 3-lobed, lobes 2.5 mm long, 1 mm wide. Stamens 9–11 mm long, filaments glabrous, thecae 2.5–3 mm long, subequal to equal in length, unequally inserted (overlapping by 0.2 mm) to superposed (contiguous), ± parallel, both with a basal appendage 0.2–0.7 mm long (appendages larger on lower thecae), at least distal theca dorsally pubescent with a few trichomes (possibly glandular?); pollen (fide Gibson 1972) 3-aperturate, apertures flanked on each side by 1 row of insulae. Style not seen. Capsules not seen.

PHENOLOGY.— Flowering: December; fruiting: unknown.

HABITAT.— Moist and forested slopes; 300–900 m.

Izabal: *Steyermark 42001* (type, see above).

Because Gibson's name for this species was a later homonym, Bennet and Chandra (1982) proposed another one for it.

Justicia gibsoniae is endemic to Guatemala (Izabal), and remains known only from the type collection. Although the exact locality of collection on Cerro San Gil is not known, it presumably lies within one of the protected regions that encompass most of that montane system. The conservation status of this species remains unknown, but it might be regarded as possibly extirpated until plants of it are relocated.

***Justicia inaequalis* Benth.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: October–March; fruiting: January–March.

HABITATS.— Wet montane forests, cloud forests, moist evergreen forests, mixed forests, dry secondary forests, moist thickets, moist forested ravines, along streams; 450–2400 m.

Alta Verapaz: *Véliz et al. 20002* (BIGU). **Chimaltenango**: *Standley 61994* (F, US). **Escuintla**: *Standley 61296* (F, US). **Guatemala**: *Aguilar 603* (F). **Huehuetenango**: *Velásquez s.n.* 17-XII–2008 (BIGU). **Quezaltenango:** *Hartweg 553* (holotype: K; isotypes: BM, G, K, P). **Retalhuleu**: *Shannon 258* (US). **Sacatepéquez**: *Daniel & Véliz 11210* (BIGU, CAS, K, MO). **San Marcos**: *Steyermark 37335* (F). **Sololá**: *Quedensley 4874* (BIGU).

Collections from Petén and Izabal that have been identified with this name are treated as a distinct species, *J. velizii* (see below).

***Justicia kanal* T.F. Daniel**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: March–May; fruiting: unknown.

HABITATS.— Tall forests, zapotales; 300 m.

Izabal: *Contreras 11182* (F, LL, MO, US). **Petén:** *Lundell 2189* (holotype of *Beloperone aurea* Leonard: US; isotypes: LL, MICH).

Gibson (1974) treated this species under the name *J. flava* D.N. Gibson, an illegitimate nomenclatural synonym (Daniel 1995b).

***Justicia lindeniana* (Nees) Macbride**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: May, December; fruiting: May, December.

HABITAT.— In and along streams; 75 m.

Izabal: *Muenscher 12581* (F).

Although rarely collected in Guatemala, this species is more abundant in southern Mexico where it occurs along streams in lowland rain forests and montane rain forests at elevations from 130 to 1700 meters.

***Justicia macrantha* Benth.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: May–June; fruiting: unknown.

HABITAT.— Unknown; 1900 m.

LOCAL NAME.— "Cuajatinta" (*Tejada 8*).

Guatemala: *Tejada 8* (US). **Quezaltenango:** *Hartweg 551* (holotype: K; isotypes: BM, K, P).

This species is known only from a few collections in Guatemala. Gibson (1974) reported it from Alta Verapaz, but no collections from that department were located during this study. It was collected recently in Quezaltenango (*E. Tribouillier s.n.* in 2007 at BIGU). In Chiapas, it occurs in regions of cloud forest.

***Justicia micrantha* (Oerst.) V.A.W. Graham, Kew Bull. 43:603. 1988, non Wall. (1830), nom. nud. nec Pohl ex Nees (1847), in syn. *Chaetothylopsis micrantha* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854:163. 1855**. *Chaetothylax micranthus* (Oerst.) Benth. & Hook.f. ex Hemsl., Biol. Centr.-Amer., Bot. 2:515. 1882. TYPE.— Nicaragua. **Segovia**: without locality, savanna, Jan, *A. Oersted 10635* (holotype: C!; isotype: K!).

Chaetothylax rothschuhii Lindau, Bull. Herb. Boissier 3:492. 1895. *Justicia rothschuhii* (Lindau) Durkee, Novon 9:510. 1999. TYPE.— Nicaragua. **Matagalpa**: river bank near Mazmaz, 200 m, 22 Mar 1894, *Rothschuh 410* (holotype: B, destroyed); Nicaragua. **Chontales**: ca. 2.8 km N of Cuapa, disturbed evergreen forest on hillside, 12°17′N, 85°23′W, 400–500 m, 21 Jan 1978, *W. Stevens 6143* (neotype, designated by Durkee in 1999: MO!).

Chaetothylax leucanthus Leonard, Contr. U.S. Natl. Herb. 31:663. 1958. TYPE.— Colombia. **Bolívar**: edge of thicket in Buenavista, E of Sincé, 100–200 m, 24 Jan 1918, *F. Pennell 3985* (holotype: NY; isotype: GH).

Decumbent to erect perennial herbs to 1 m tall. Young stems ± bifariously pubescent with flex-

uose to retrorse eglandular trichomes 0.3–1 mm long. Leaves petiolate, petioles to 25 mm long, blades ovate to elliptic, 30–110 mm long, 12–40 mm wide, 2.1–3.5 times longer than wide, acute to acuminate at apex, attenuate at base, surfaces subcoriaceous, pubescent (sometimes very sparsely so) with eglandular trichomes, margin often ± revolute. Inflorescence of axillary dichasiate spikes or panicles of spikes, these often in clusters and crowded near shoot apex forming a dense, sometimes fan-shaped, terminal compound inflorescence; spikes or panicles of spikes 1–2 (or more) per axil, spikes unilateral, rachis sparsely pubescent with erect to flexuose eglandular and glandular trichomes 0.05–0.1 mm long; dichasia alternate (i.e., 1 per spike node), sessile, 1-flowered. Bracts opposite, subulate, 5–9 mm long, 0.2–0.4 mm wide, abaxial surface pubescent like rachis and sometimes with antrorse eglandular trichomes to 0.5 mm long as well, margin ciliate with erect to flexuose to antrorse eglandular trichomes to 1 mm long. Bracteoles subulate, 6–9.5 mm long, 0.2 mm wide, pubescent like bracts. Calyx 4-lobed, 9–13.5 mm long, lobes subulate, 8.7–13 mm long, equal to subequal, pubescent like bracts except glandular trichomes usually more conspicuous. Corolla white, 9.5–16 mm long, externally pubescent with flexuose eglandular trichomes 0.1–0.3 mm long, tube ± cylindric (expanded only at apex, if at all), 7.5–14 mm long, 0.6–0.8 mm in diameter near midpoint, throat not evident or inconspicuous, upper lip 2–3.5 mm long, emarginate to 2-lobed, lobes to 0.4 mm long, lower lip 2–3.5 mm long, lobes 1.5–2.7 mm long, 1–1.6 mm wide. Stamens 3 mm long, inserted near apex of corolla tube, exserted from mouth, filaments glabrous, thecae 0.4–1 mm long, subparallel to subperpendicular, subequal to unequal in size (upper larger), lower theca sometimes abortive and appearing as a sterile appendage to 0.2 mm long, unequally inserted (overlapping by 0.2–0.3 mm) to superposed (contiguous or with a gap to 0.5 mm long), glabrous, lower theca with a basal appendage 0.05–0.1 mm long; pollen 2-aperturate, apertures flanked on each side by 2 rows of insulae. Style 9–13 mm long, proximally sparsely pubescent with eglandular trichomes, distally glabrous, stigma to 0.2 mm long, lobes not evident. Capsule 4.9–7 mm long, pubescent with erect to flexuose to retrorse glandular (sometimes very sparse, inconspicuous, or apparently absent) and eglandular trichomes 0.1–0.2 mm long, stipe 1.5–2.7 mm long, head with slight medial constriction, 3–4.4 mm long. Seeds 4, leticular, 1–1.5 mm long, 0.9–1.3 mm wide, surface and margin covered with trichomelike papillae bearing apical barbs.

PHENOLOGY.— Flowering: March; fruiting: March.

HABITATS.— Lake shores, dry thickets; 250–300 m.

Escuintla: *Standley 89140* (US). **Petén**: *Lundell 18307* (F, LL, MO, US).

Guatemalan plants of *Justicia micrantha* were treated by Gibson (1974) as *Chaetothylax rothschuhii* Lindau. Daniel (2005) noted the distribution of and names applied to this species. The description above pertains to plants from Guatemala, Honduras, and Nicaragua.

***Justicia multicaulis* Donn. Sm.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: December–February, June, October; fruiting: December–February.

HABITATS.— Montane forests, cloud forests, moist forests, second growth, along streams; 1210–1600 m.

Alta Verapaz: *von Tuerckheim 741* (lectotype: US; isolectotypes: MICH, US). **Baja Verapaz:** *Lundell & Contreras 21157* (F, LL, MO, US). **Huehuetenango:** *Steyermark 48884* (holotype of *J. alsophila* Standl. & Leonard: US; isotypes: F, MICH).

Gibson (1974) did not treat *J. alsophila*, but indicated that it resembled *J. multicaulis*. Daniel (1995b) treated them as conspecific. Corollas were described by Gibson (1974) as white with the

upper lip purplish and by Daniel (1995b) as white with maroon-purplish markings on the lips. Corollas observed during these studies were light pink and with maroon and white markings on the lower lip.

This species is endemic to Chiapas and Guatemala. It was collected most recently from the Sierra de Chamá in Alta Verapaz (*Daniel et al. 11358* at BIGU, CAS, K, MO), where more than 50 plants were noted along a trail of ca. 100 m in a cloud forest remnant. The species was not observed in disturbed regions outside of the forest.

Justicia neomontana **S.S.R. Bennet & S. Chandra, J. Econ. Taxon. Bot. 3(2):602. 1982.** *Beloperone montana* Standl. & Leonard in P.C. Standley and J.A. Steyermark, Publ. Field Mus. Nat. Hist., Bot. 23:237. 1947. *Justicia montana* (Standl. & Leonard) D.N. Gibson, Fieldiana: Bot. 34:70. 1972, non Roxb. (1805). **Type.**— GUATEMALA. **Izabal**: uppermost summit of Cerro San Gil, 1200–1300 m, 26–27 Dec 1941, *J. Steyermark 41939* (holotype: F!; isotype: US!).

Perennial herbs to 1.5 dm tall. Young stems quadrate-sulcate to ± flattened, 4-fariously pubescent with flexuose eglandular trichomes to 1.8 mm long. Leaves petiolate, petioles to 15 mm long, blades elliptic, 57–110 mm long, 36–64 mm wide, 1.4–2.1 times longer than wide, acute at base, acute at apex, surfaces pubescent with flexuose to antrorse eglandular trichomes. Inflorescence of terminal panicles (of spikes) to 130 mm long, main rachis pubescent like young stems, inflorescence bracts subtending lateral dichasiate spikes linear to narrowly elliptic, 6–8 mm long, 0.8–1 mm wide; spikes to 40 mm long; dichasia sessile, alternate, 1-flowered. Bracts alternate, heteromorphic; fertile bracts spatulate to obovate, 10–14 mm long, 2–4 mm wide, abaxially and marginally pubescent with flexuose eglandular trichomes to 2 mm long; sterile bracts oblanceolate to linear, 3–6 mm long, 0.3–0.7 mm wide, pubescent like bracts. Bracteoles oblanceolate to spatulate to linear-elliptic, 9–12 mm long, 1.5–2.2 mm wide, abaxial surface and margins pubescent like bracts. Flowers sessile. Calyx 5-lobed, 5–6.5 mm long, lobes lanceolate, 4–5.5 mm long, abaxial surface sparsely pubescent with flexuose eglandular trichomes, margin pubescent like bracts. Corolla "dark and pale purple," 21 mm long, externally pubescent with glandular trichomes 0.1–0.3 mm long, tube 13 mm long, 2.7 mm in diameter near midpoint, little (if at all) expanded distally (i.e., undifferentiated into narrow proximal portion and throat), with an externally protruding pouch in lower half near where stamens attached, upper lip 8.5 mm long, 2-fid, lower lip 9 mm long. Stamens inserted in lower half of corolla tube, anthers not seen; pollen (fide Gibson 1972) 4-aperturate, apertures flanked on each side by 1 row of insulae (these sometimes ± partially coalesced). Style not seen. Capsule 8–11.5 mm long, pubescent with erect to flexuose eglandular trichomes 0.1–0.4 mm long, stipe 2.5–5.5 mm long, head 5.5–6.5 mm long. Seeds 4, lenticular, 2.3 mm long, 2.1 mm wide, lacking trichomes, surface appearing smooth (micropapillose).

Phonology.— Flowering: December; fruiting: December.

Habitats.— Montane ridges and summits; 1200–1300 m.

Izabal: *Steyermark 41939* (type, see above).

Standley and Steyermark (1947) provided an illustration of this species in the protologue. Because Gibson's combination in *Justicia* for this species was a later homonym, Bennet and Chandra (1982) proposed another one for it.

This species is endemic to Guatemala (Izabal) and remains known only from the type collection. Although the exact locality of collection on Cerro San Gil is not known, the notation of its occurrence on the uppermost summit above 1200 meters reveals that the type locale lies within the Reserva Protectora de Manantiales Cerro San Gil. The conservation status of this species remains unknown, but it might be regarded as possibly extirpated until plants of it are relocated.

***Justicia pectoralis* Jacq.**

Recent Description.— Daniel (1995b).

Phenology.— Flowering: December–May; fruiting: February–March.

Habitats.— Lowland forests, short thickets, dry thickets, along streams, moist areas along roads; 50–1100 m.

Alta Verapaz: *Steyermark 44233* (F). **Escuintla**: *Standley 89141* (F). **Izabal**: *Contreras 7568* (F, LL, MO). **Petén**: *Steyermark 45495* (F, MICH, US). **Retalhuleu**: *Standley 87396* (F, US).

Gibson (1974) reported the occurrence of the species in Chiquimula and Guatemala, but no collections from those departments were located during this study.

***Justicia pedicellata* D.N. Gibson, Fieldiana, Bot. 34:70. 1972. Type.**— GUATEMALA. **Alta Verapaz**: Samac to Chamá, ca. 1200 m, 23 Oct 1920, *H. Johnson 780* (holotype: F!; isotype: US!).

Perennial herbs or shrubs to 2 m tall. Young stems subterete to quadrate-sulcate, glabrous or nearly so. Leaves sessile to petiolate, petioles to 5 mm long, blades ovate to elliptic, 30–103 mm long, 11–33 mm wide, 2.7–4.1 times longer than wide, acuminate at apex, acute to subattenuate at base, surfaces glabrous (or abaxial surface sometimes glandular punctate), margin entire to subcrenate. Inflorescence of axillary and terminal pedunculate cymules; cymules usually opposite at nodes, 1–3 per axil of distal leaves or 1–3 (–6) at terminal node, peduncles 5–52 mm long, glabrous, outer cymule bracteoles green flecked with maroon to maroon, deltate to cordate, 12–21 mm long, 6.5–11 mm wide, equal to subequal in size, truncate to cordate at base, abaxial surface glabrous, inner cymule bracteoles sublinear to lance-ovate to ovate, 8–10.3 mm long, 1.8–3.5 mm wide, abaxial surface glabrous. Flowers 1 per cymule, sessile. Calyx 5-lobed, 7–8 mm long, tube 1 mm long, lobes lanceolate, 6–7 mm long, 0.9–1.2 mm wide, abaxially glabrous, margin sometimes sparsely ciliate with flexuose eglandular trichomes 0.1–0.2 mm long. Corolla red, 26–41 mm long, externally pubescent with mostly retrorse eglandular trichomes 0.2–0.4 mm long and sometimes with erect glandular trichomes 0.1–0.2 mm long as well, tube 16–25 mm long, gradually expanded from base, upper lip 12.5–17 mm long, apically emarginate, lower lip 12–16 mm long, lobes 1–2.5 mm long, 1–1.8 mm wide. Stamens 12–19 mm long, filaments distally glabrous, thecae 2.1–2.8 mm long, subequal (lower slightly longer), subparallel to subperpendicular, unequally inserted (overlapping by 0.6–1.2 mm), upper theca sparsely pubescent dorsally with eglandular trichomes and with a basal spur to 0.2 mm long, lower theca with a blunt basal appendage 0.3–0.6 mm long; pollen 3-aperturate, apertures flanked on each side by 1 row of insulae. Style 29–38 mm long, stigma 0.2 mm long, minutely 2-lobed. Capsule 9.5–11 mm long, glabrous, stipe 3–4.5 mm long, head ellipsoid, 6.5–7 mm long. Seeds 4, lenticular, 2.5–3 mm long, 1.9–2.3 mm wide, surfaces and margin pubescent with ± trichome-like papillae, 0.05–0.1 mm long, papillae sometimes very sparse or only evident on margin.

Phenology.— Flowering: October, February; fruiting: February–March.

Habitat.— Cloud forests, riparian forests; 275–1350 m.

Alta Verapaz: *Daniel et al. 11355* (BIGU, CAS, K, MICH, MO, US).

Glandular trichomes are present on *Steyermark 44196* but they are not evident on the type. Gibson (1972) described pollen of this species as 2-aperturate; pollen of *Johnson 780* and *Véliz 95.4376* is 3-aperturate (Fig. 7). Gibson (1972) also provided an illustration of this species.

This Guatemalan endemic is known only from Alta Verapaz, where it has been collected at least six times, most recently during 2010 in the Sierra de Chamá (*Daniel et al. 11355* at BIGU, CAS, K, MICH, MO, US). The locality visited in 2010 consists of a four square kilometer cloud

forest remnant in a region where much of the forest has been removed for agriculture and pasturage. At this site, the species is a common (more than 100 plants were noted) understory shrub both in and along the edge of the forest. Although the species is extant, it is restricted in distribution, and its overall conservation status remains unknown. It should be regarded as rare until additional information becomes available.

***Justicia pringlei* B.L. Rob.**

RECENT DESCRIPTIONS.— Daniel (1995b), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: unknown; fruiting: unknown.

HABITAT.— Unknown; elevation unknown.

Quiché: *Aguilar 1513* (F).

Aguilar's collection does not provide any information relating to specific locale, habitat, or date of collection. Although rare or possibly extirpated in Guatemala, this species is widespread in central to southern Mexico where it occurs in xerophytic scrub, oak savannas, and pine-oak forests at elevations from 920 to 2000 meters.

***Justicia ramosa* (Oerst.) V.A.W. Graham**

RECENT DESCRIPTIONS.— Daniel (1995b, 1999a).

PHENOLOGY.— Flowering: August–January; fruiting: August–January.

HABITATS.— Tropical deciduous forests, moist thickets, brushy slopes; 225–850 m.

El Progreso: *Cóbar & Ramirez 646* (BIGU). **Jutiapa**: *Standley 75836* (F). **Zacapa:** *Blake 7669* (holotype of *S. discolor* Blake: US; isotypes: F, GH).

Gibson (1972, 1974) included this taxon within *Siphonoglossa sessilis* (Jacq.) Oerst. ex Radlk., a closely related species as treated by Hilsenbeck (1989) that is not known from Guatemala. Although she attributed to herself the combination in *Siphonoglossa* for Jacquin's *Justicia sessilis*, as noted by Hilsenbeck (1989), it had been published previously by Radlkofer (1883). Although Gibson's superfluous combination is cited by *Index Kewensis* and the *Gray Herbarium Card Index*, Radlkofer's earlier and valid one is not.

Hilsenbeck (1989) treated *Siphonoglossa discolor*, known only by Blake's collection from Zacapa, as *S. ramosa* var. *discolor* (S.F. Blake) Hilsenb.; he noted the following distinctions for the variety: strongly discolorate leaves, cuneate leaf bases, usually prominent apiculate leaf apices, and short (0.1 mm long) and evenly disposed cauline pubescence. He treated two of Standley's collections from Jutiapa within *S. ramosa* var. *hondurensis* (Standl. & Steyerm.) Hilsenb. Daniel (2005) noted that the distinctions attributed to this variety among Honduran plants were untenable, and neither variety is recognized herein.

***Justicia ramulosa* (Morong) C. Ezcurra, Bol. Soc. Argent. Bot. 25:350. 1988.** *Beloperone ramulosa* Morong, Ann. New York Acad. Sci. 7:194. 1893. *Justicia ramulosa* (Morong) V.A.W. Graham, Kew Bull. 43:604. 1988. TYPE.— PARAGUAY. **Asunción**: "central Paraguay," 1888–1890, *T. Morong 706* (holotype: NY; isotypes: BM, E, G, K, MO, NY, US!).

Beloperone tetramerioides Lindau, Bull. Herb. Boissier 3:488. 1895. *Justicia tetramerioides* (Lindau) V.A.W. Graham, Kew Bull. 43:603. 1988. TYPE.— BOLIVIA. **Santa Cruz**: Yapacani, 400 m, July 1892, *O. Kuntze s.n.* (holotype: B, destroyed; isotype: NY).

Beloperone cochabambensis Rusby, Mem. Torrey Bot. Club 6:103. 1896. *Justicia cochabambensis* (Rusby) V.A.W. Graham, Kew Bull. 43:603. 1988. TYPE.— BOLIVIA. **Cochabamba**: "Espirito Santo," vicinity of Cochabamba, 1891, A. *Bang 1215* (holotype: NY; isotypes: BM, E, G, K, M, MO, NY, US! W).

Beloperone pseudociliata Mildbr., Notizblatt 9:1159. 1927. *Justicia pseudociliata* (Mildbr.) V.A.W. Graham, Kew Bull. 43:603. 1988. **Type**.— BOLIVIA. **Santa Cruz**: Río Palometillas, Buenavista, 450 m, 24 Jun 1925, *I. Steinbach 7137 bis* (holotype: B, destroyed; isotypes: BM, K, MO, NY, UC)

Chaetothylax cuspidatus D.N. Gibson, Fieldiana, Bot. 34:58. 1972, non *J. cuspidata* Vahl (1790). *Justicia danielii* L.H. Durkee, Novon 9:508. 1999. **Type**.— GUATEMALA. **Alta Verapaz**: Roblaron, valley of the Sta. Lucia, road from Gualán to Copán, 650 m, January 1907, *H. Pittier 1792* (holotype: US!).

Perennial herbs to 4 dm tall. Young stems subquadrate, 2-fariously pubescent with flexuose to retrorse eglandular trichomes 0.5–1.7 mm long. Leaves petiolate, petioles to 20 mm long, blades ovate to elliptic, 30–105 mm long, 15–45 mm wide, 2.0–3.1 times longer than wide, acute to acuminate at apex, acute to attenuate at base, surfaces pubescent with mostly retrorse eglandular trichomes concentrated on (or restricted to) major veins, margin entire. Inflorescence of axillary (near shoot apex) and terminal dichasiate spikes, spike rachises ± 2-fariously pubescent with flexuose eglandular trichomes (especially at nodes), dichasia opposite, sessile, 1-flowered. Bracts opposite, obovate-elliptic to obovate, 11.5–16 mm long, 3.3–6 (–7.5) mm wide, aristate at apex, mucro to 2 mm long, abaxial surface sparsely pubescent with antrorse eglandular trichomes 0.3–1.2 mm long, margin ciliate with flexuose eglandular trichomes to 2.2 mm long. Bracteoles subulate, 6–10 mm long, 0.5–0.7 mm wide, abaxial surface nearly glabrous or pubescent like bracts, margin pubescent like bracts. Calyx 4-lobed, 6.5–8.5 mm long, lobes subulate, 6–8 mm long, 0.5–0.8 mm wide, abaxially and marginally pubescent like bracteoles. Corolla reddish purple, 31–34 mm long, externally pubescent with flexuose eglandular trichomes 0.1–0.6 m long, tube ± gradually expanded distally, 21–22 mm long, 1.5–2 mm in diameter near midpoint, upper lip 9–12 mm long, shallowly 2-lobed at apex, lobes 0.3 mm long, lower lip 10–14 mm long, lobes 5–5.5 mm long, 2.3–3.5 mm wide. Stamens 9 mm long, filaments pubescent with eglandular trichomes near base, glabrous distally, thecae subparallel to subperpedicular, 0.9–1.5 mm long, subequal to unequal in size (upper theca larger, lower theca sometimes abortive or not evident), glabrous, superposed (contiguous or with a gap 0.05–0.5 mm), lower theca with a basal appendage to 0.3 mm long; pollen 2-aperturate, apertures flanked on each side by 2 (–3) rows of insulae. Style 27 mm long, glabrous distally, stigma 0.5 mm long, inconspicuously 2-lobed. Capsule 6–8 mm long, pubescent with flexuose to retrorse eglandular trichomes 0.05–0.2 mm long, stipe 1.5–3 mm long, head subellipsoid with slight medial constriction, 4.2–5 mm long. Seeds lenticular to sublenticular, 1.5–1.9 mm long, 1.4–1.8 mm wide, covered with stout papillae bearing retrorse barbs.

Phenology.— Flowering: January; fruiting: unknown.

Habitats.— Moist forests, disturbed sites (e.g., cafetales); 650 m.

Alta Verapaz: *Pittier 1792* (type of *Chaetothylax cuspidatus*, see above).

Because this widespread pecies is not well collected in Guatemala, the description above has been augmented with information from specimens occurring elsewhere in Central America. Guatemalan plants of *J. ramulosa* were treated by Gibson (1974) as *Chaetothylax cuspidatus*. Ezcurra (2002) noted that the South American species *J. ramulosa* was similar to the North American species *Chaetothylax cuspidatus* and *J. teletheca* T.F. Daniel. Indeed, Lindau had annotated the type of *C. cuspidatus* from Guatemala as *Beloperone ramulosa*. Daniel (2005) treated the former name as a synonym of *J. ramulosa*; the latter species can be distinguished by the following couplet:

1. Inflorescence rachis pubescent with both glandular and eglandular trichomes distally (glandular pubescent); bracts apically acute, distal bracts abaxially and marginally glandular pubescent; bracteoles 4–6 mm long, 0.3–0.5 mm wide; calyx 9–11 mm long, lobes linear to linear-lanceolate; corolla externally glandular pubescent, tube 17–19 mm long; anther thecae separated by a gap of 1.5–3 mm, distal theca 2–2.5 mm long; pollen with 3–4 rows of insulae on each side of apertures; capsules glandular pubescent ..... *J. teletheca*
1. Inflorescence rachis pubescent throughout with eglandular trichomes only; bracts apically aristate (mucros to 2 mm long), distal bracts abaxially and marginally pubescent with eglandular trichomes only; bracteoles 6–10 mm long, 0.5–0.7 mm wide; calyx 6.5–8.5 mm long, lobes subulate to lanceolate; corolla externally pubescent with eglandular trichomes only, tube 21–22 mm long; anther thecae contiguous or separated by a gap of 0.05–0.5 mm, distal theca up to 1.5 mm long; pollen with 2 (–3) rows of insulae on each side of apertures; capsule pubescent with eglandular trichomes only ..... *J. ramulosa*

Justicia sangilensis **T.F. Daniel & M. Véliz**

Recent Description.— Daniel and Véliz (2009).

Phenology.— Flowering: October, January; fruiting: October, January.

Habitat.— Lower montane rain forests; ca. 875 m.

Izabal: *Daniel et al. 11249* (holotype: BIGU; isotypes: BR, CAS, F, K, MO, US).

This distinctive species was recently described from the Cerro San Gil where it is endemic; Daniel and Véliz (2009) provided an illustration and photographs of the species and its pollen. It differs from other *Justicia* by the combination of its arboreal (to 8 m tall) habit, reddish involucre of four cymule bracteoles subtending each flower, and large yellowish corollas. It is known only from two sites in the Reserva Ecológica de Cerro San Gil; at each one it is locally abundant. Although not in imminent danger of extinction, this highly unusual species should be regarded as rare.

Justicia silvicola **D.N. Gibson, Fieldiana: Bot. 34:73. 1972. Type.**— GUATEMALA. **Izabal**: Cerro San Gil, uppermost ridges and summit, 1200–1300 m, 26–27 Dec 1941, *J. Steyermark 41984* (holotype: F!; isotype: US!).

Perennial herbs to 5 dm tall. Young stems quadrate-sulcate to ± flattened, glabrous (or with some internodes ± 2-fariously pubescent with erect subglandular trichomes to 0.1 mm long). Leaves petiolate, petioles to 13 mm long, blades ovate-elliptic to elliptic, 40–120 mm long, 19–42 mm wide, 2.1–3.2 times longer than wide, acuminate to apex, subattenuate to attenuate at base, surfaces glabrous, margin ± entire. Inflorescence of terminal subspicate axes to 15 mm long (excluding flowers), rachis glabrous; dichasia opposite in axils of bracts (or lowest pair in axils of distal pair of leaves), 1 per axil, 1-flowered, subsessile (i.e., borne on peduncles to 1 mm long). Bracts obovate-spatulate, 9–10 mm long, 3–3.5 mm wide, abaxial surface glabrous. Bracteoles oblanceolate-spatulate, 5–8 mm long, 1.2–1.5 mm wide, abaxial surface glabrous. Flowers sessile. Calyx 6–6.5 mm long, lobes lanceolate, 4.5–5.5 mm long, 0.7–1 mm wide, abaxially glabrous. Corolla "white," 18–19 mm long, externally glabrous, tube 13–14 mm long, narrow proximal portion 9–10 mm long, 1.2–1.5 mm in diameter near midpoint, ± abruptly expanded distally into a throat, throat 2–3 mm long, upper lip 6 mm long, lower lip 6.5 mm long, lobes 3–5 mm long, 2.7–6.5 mm wide. Stamens 4.6 mm long, inserted at base of throat, filaments glabrous, thecae 1.3–1.8 mm long, unequal in size (lower larger), unequally inserted (overlapping by 0.5–0.6 mm), upper theca dorsally pubescent with eglandular trichomes, lower theca with a spurlike basal appendage 0.7–0.8

mm long; pollen (fide Gibson 1972) 4-aperturate, apertures flanked on each side by 2 rows of insulae. Style and stigma not seen. Capsule 11–12 mm long, glabrous, stipe 5 mm long, head subellipsoid. Seeds lenticular, 2.8–3 mm long, 2 mm wide, surfaces and margin covered with apically barbed or branched papillalike trichomes to 0.1 mm long.

PHENOLOGY.— Flowering: December; fruiting: December.

HABITATS.— Montane ridges and summits; 1200–1300 m.

Izabal: *Steyermark 41984* (type, see above).

One of the distinctive features of the species, apically barbed or branched trichomes on the seeds, is encountered in several other species from North America and Central America (e.g., *J. pringlei* B.L. Rob., *J. wendtii* T.F. Daniel, *J. wrightii* A. Gray). None of these is otherwise especially similar to *J. silvicola*.

Justicia silvicola is endemic to Guatemala (Izabal), and remains known only from the type collection. Although the exact locality of collection on Cerro San Gil is not known, the notation of its occurrence on the uppermost ridges and summit above 1200 meters reveals that the type locale lies within the Reserva Protectora de Manantiales Cerro San Gil. The conservation status of this species remains unknown, but it might be regarded as possibly extirpated until plants of it are relocated.

***Justicia soliana* Standl.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: October–March; fruiting: November–March.

HABITATS.— Wet forests, dry forests, wet thickets, dry thickets, rocky slopes; 500–1300 m.

LOCAL NAME.— "La aurora" (*Aguilar 429*)

Chiquimula: *Molina R. & Molina 25153* (F, MO, US). **Escuintla**: *Standley 64858* (F). **Guatemala**: *Aguilar 429* (F). **Jutiapa**: *Steyermark 31886* (F, US). **Sacatepéquez**: *Molina R. et al. 16676* (F, US). **Santa Rosa**: *Standley 78586* (F, US).

***Justicia spicigera* Schltdl.**

RECENT DESCRIPTIONS.— Daniel (1995b, 1997b), Daniel and Acosta (2003).

PHENOLOGY.— Flowering: December–May; fruiting: March.

HABITATS.— Tall forests, moist thickets; 0–1790 m.

LOCAL NAMES.— "Añil" (*Contreras 895*); "jiquilite" (*Sálas 663*); "sacatinta" (*Tejada 324*); "sacatinte" (*Cutler 4327*); "Santo Domingo" (*Morales R. 1274*); "tinta" (*Standley 68367*; *Steyermark 33707*).

LOCAL USES.— Leaves used for blue dye (*Cutler 4327*); plant used medicinally to treat dysentery (fide mother of L. Velásquez, pers. comm.).

Alta Verapaz: *Johnson 316* (F, US). **Chimaltenango**: *Cutler 4327* (F). **Guatemala**: *Morales R. 1274* (AGUAT, F). **Huehuetenango**: *Tejada 324* (US). **Izabal**: *Jones & Facey 3473* (CAS, RSA). **Petén**: *Contreras 2192* (F, MO, LL). **Quezaltenango**: *Standley 68367* (F). **Retalhuleu**: *Donnell-Smith 2700* (US). **Sololá**: *Kellerman 5686* (LL, US).

This species, along with *J. colorifera*, has a lengthy history of both domestic and medicinal uses (see Daniel 1995b), and they are both cultivated in much of northern Latin America. *Lundell & Contreras 19164* from Baja Verapaz (see above under *J. colorifera*) is similar to both *J. spicigera* and *J. colorifera*. It differs from the former by the corolla bud not fusiform, the lower lip apparently not recoiled, and the proximal portion of the corolla tube lacking minute glands. It differs from the latter by the pubescence on its young stems and rachises. Its pollen (2-aperturate with apertures flanked on each side by 2 rows of insulae) is similar to that of both of *J. spicigera* and *J. colorifera*. It differs from both of these species by having pink corollas (based on data provided

by the collector). A very similar plant from Alta Verapaz at F (*Standley 69470*; see above under *J. colorifera*) has this same combination of characters except that collector's notes indicate pale red corollas. Plants of this collection were noted to be common in gardens and hedges. The taxonomic disposition of these anomolous collections must await additional studies.

***Justicia steyermarkii* Standl. & Leonard in P.C. Standley and J.A. Steyermark, Publ. Field Mus. Nat. Hist., Bot. 23:243. 1947, non *J. steyermarkii* (Leonard) Leonard (1958).** TYPE.— GUATEMALA. **Huehuetenango**: Sierra de los Cuchumatanes, between Xoxlac and Nucapuxlac, 1650–2500 m, 17 Jul 1942, *J. Steyermark 48934* (holotype: US!; isotype: F!).

Perennial herbs to shrubs to 1.2 m tall. Young stems quadrate-sulcate, pubescent with antrorse eglandular trichomes 0.2–0.4 mm long, trichomes concentrated in (but not restricted to) 2 lines, often with dark septae. Leaves petiolate, petioles to 10 mm long, blades lance-ovate to ovate, 16–65 mm long, 4–19 mm wide, 3.4–4.5 times longer than wide, acuminate at apex, acute to subattenuate at base, surfaces pubescent with antrorse eglandular trichomes, margin entire. Inflorescence of axillary mostly pedunculate spikes to 12 mm long (including peduncle and excluding flowers); spikes mostly opposite in axils of distal leaves (leaves becoming much reduced in size distally), 1 per axil, subsessile to pedunculate, peduncles 0.5–4.5 mm long, pubescent like young stems or with trichomes more evenly disposed, rachis pubescent like peduncles; dichasia alternate, sessile in axils of bracts, 1 per axil, 1-flowered. Bracts opposite, sterile and fertile ones ± heteromorphic (fertile bracts slightly larger than sterile ones), spatulate, 4.5–10 mm long, 1.5–2.5 mm wide, abaxial surface pubescent with antrorse eglandular trichomes 0.05–0.2 mm long, margin ciliate with flexuose eglandular trichomes to 0.6 mm long. Bracteoles spatulate, 3–8 mm long, 1–1.7 mm wide, abaxial surface pubescent like bracts and sometimes with glandular trichomes to 0.2 mm long as well. Flowers sessile. Calyx 5-lobed, 5–6 mm long, lobes lance-subulate, 4–5 mm long, 0.8–1 mm wide, abaxially pubescent like bracts. Corolla "dull purple" and white with dull purple markings on lower lip, 21 mm long, externally pubescent with erect to flexuose eglandular trichomes 0.05–0.3 mm long, tube 8 mm long, narrow proximal portion 2 mm long, abruptly expanded into throat, throat 6 mm long, upper lip 13 mm long, apically 2-fid, lower lip 10 mm long, lobes 1.5–2 mm long, 2–3 mm wide. Stamens 11 mm long, thecae 2–2.2 mm long, subperpendicular, subequal in size, unequally inserted (overlapping by up to 1 mm), both theca dorsally pubescent with eglandular trichomes, lower theca with a basal appendage to 0.5 mm long; pollen unknown. Style 19 mm long, pubescent with eglandular trichomes, stigma 0.1 mm long, lobes (if present) not evident. Capsule not seen.

PHENOLOGY.— Flowering: July; fruiting: unknown.

HABITAT.— Unknown; collected between "1500–2600" m.

Huehuetenango: *Steyermark 48590* (F, US).

An illustration of this species was provided in the protologue (Standley and Steyermark 1947).

Justicia steyermarkii is endemic to Guatemala (Huehuetenango) and remains known only by Steyermark's two collections made in 1942 from the Sierra de los Cuchumatanes. This mountain range is rich in endemics, and remains inadequately explored. Although its conservation status is unknown, the species might be regarded as possibly extirpated until plants of it are relocated.

***Justicia sulfurea* (Donn. Sm.) D.N. Gibson**

RECENT DESCRIPTION.— Daniel (2004a).

PHENOLOGY.— Flowering: September–October; fruiting: January.

HABITATS.— Disturbed forests, moist thickets, along streams, rocky slopes; 1140–1500 m.

LOCAL NAME.— "Sacatinta" (*Molina R. & A. Molina 27794*).

Baja Verapaz: *Molina R. & Molina 27794* (EAP, F, TEX, USCG). **Santa Rosa**: *Heyde & Lux 6215* (lectotype: US; isolectotypes: A, F, GH, MO, US).

Gibson (1972, 1974) noted that this rarely collected species was known to her only from the type collection. Other collections resembling the type have since been located, including one in El Salvador (Daniel 2001, 2004a). The most recent known collection of *J. sulfurea* was made in 1972 by the Molinas in Guatemala. Pollen of this species, which is nearly endemic to Guatemala, was illustrated by Daniel (2004a).

***Justicia tianguensis* T.F. Daniel**

RECENT DESCRIPTIONS.— Daniel (1995a, 1995b).

PHENOLOGY.— Flowering: February; fruiting: unknown.

HABITATS.— Wet mixed forests, thickets, along streams; "1300–1500" m.

Alta Verapaz: *Williams et al. 40603* (F).

Gibson (1974) annotated and treated the collection cited above as *J. inaequalis*. In the protologue of *J. tianguensis* (Daniel 1995a), in which William's collection was cited as a paratype, the distinctions between these two taxa were enumerated. *Justicia tianguensis* is endemic to, and apparently rare throughout its range in, Guatemala and Chiapas.

***Justicia valvata* T.F. Daniel**

RECENT DESCRIPTIONS.— Daniel (1993c, 2003).

PHENOLOGY.— Flowering: December; fruiting: unknown.

HABITAT.— Tall forests; elevation ca. 200–300 m.

Petén: *Contreras 9311* (F, K, LL, MO, PH, S, US).

Although known from a single locale in Guatemala, *J. valvata* has been collected several times in Veracruz, Mexico. Daniel (2003) treated this and three other species of *Justicia* in section *Megalostoma* (see below under *J. viridescens*). Another collection (*Contreras 8854* at F, LL, MO, S, US) from a region in Petén (La Cumbre, Cadenas Road at KM 160 west) near to where *Contreras 9311* was collected (Los Arcos, Cadenas Road at KM 143 west) also pertains to this section. Although it lacks corollas, based on its inflorescence (e.g., pedunculate dichasia) and pubescence (e.g., evenly pubescent young stems with the trichomes antrorsely appressed and up to 1 mm long, and abaxially pubescent calyx lobes) it appears more like *J. tabascina* from Mexico that to either of the Guatemalan species of section *Megalostoma*. It differs from *J. tabascina* by its somewhat longer cauline trichomes, antrorsely appressed and longer trichomes on the calyx, dichasia borne in the axils of distal leaves instead of in axils of bracts, and longer bracteoles. Study of corollas and pollen from plants similar to *Contreras 8854* should help determine their taxonomic disposition.

***Justicia velizii* T.F. Daniel, sp. nov.**

Figure 10

TYPE.— GUATEMALA. **Izabal**: Quebrada Seca, ca. 9.2 km (air) NW of Río Dulce, 15°41'52.1"N, 89°04'48.6"W, 165 m, lowland rain forest, in floodplain of river, limestone parent material, 25 January 2009, *T. Daniel and M. Véliz 11257* (holotype: BIGU!; isotypes: BR! CAS! F! K! MICH! MO! TEX! US!).

Perennis caulibus usque ad 3 m altis. Folia petiolata, laminae ovatae vel ovato-ellipticae, 60–200 mm longae, 15–86 mm latae, 1.9–4-plo longiores quam latiores. Inflorescentia floribus in spicas axillares et secundas vel in paniculam. Bracteae triangulares vel subulatae, 1–2.6 (–4) mm longae. Calyx 4-lobus, 7–12.5 mm longus. Corolla rosea vel rubra, 32–48 mm longa. Stamina the-

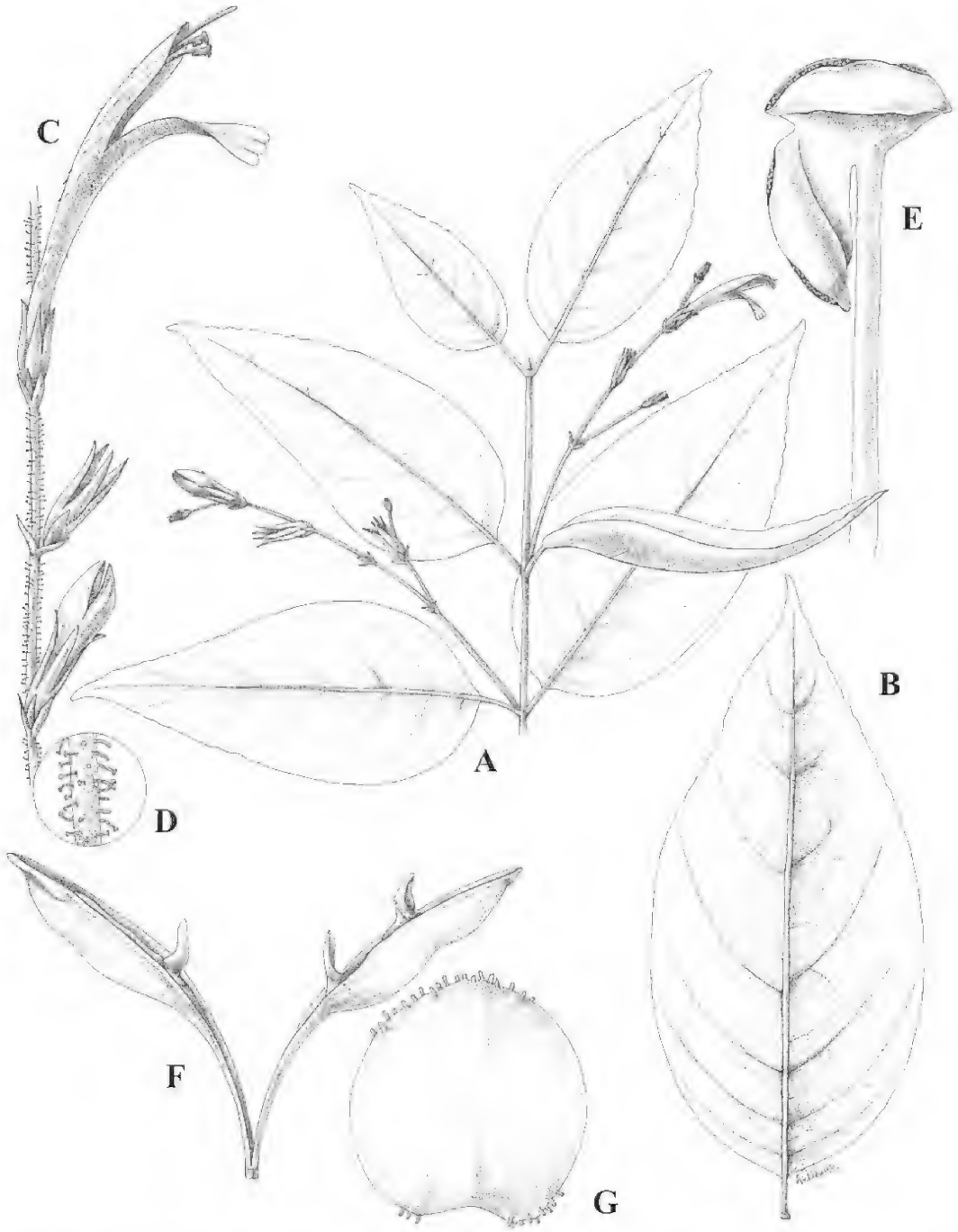


FIGURE 10. *Justicia velizii*. A. Habit (*Contreras 6183*), × 0.5. B. Leaf (*Contreras 6183*), × 0.6. C. Inflorescence with flower (*Contreras 6183* and *8890*), × 1.5. D. Trichomes of rachis (*Contreras 6183*), × 4.3. E. Distal portion of stamen with anther (*Contreras 8890*), × 12. F. Capsule (*Contreras 9354*), × 2.1. G. Seed (*Contreras 9354*), × 6. Drawn by A. Whitesides.

cis 1.5–2.8 mm longis, subparallelis vel subperpendicularibus, subaequaliter vel inaequaliter insertis, basi ecalcaratis (vel inferiore calcare usque ad 0.05 mm longo instructa). Pollen granae 2-aperturatae. Capsula 22–28 mm longa, glabra.

Perennial herbs or shrubs to 3 m tall. Young stems subquadrate to quadrate-sulcate, bifariously pubescent with (flexuose to) antrorse to antrorsely appressed eglandular trichomes 0.2–0.5 mm long. Leaves petiolate, petioles to 20 mm long, blades subcoriaceous, ovate to ovate-elliptic, 60–200 mm long, 15–86 mm wide, 1.9–4 times longer than wide, acuminate to subfalcate at apex, rounded to acute at base, abaxial surface nearly glabrous to sparsely pubescent with antrorsely appressed eglandular trichomes along major veins, adaxial surface essentially glabrous or with a few antrorsely appressed eglandular trichomes, margin entire to subcrenate. Inflorescence of axillary pedunculate secund dichasiate spikes or panicles of spicate axes to 105 mm long (including peduncles and excluding flowers), 2.5–4 mm in diameter near midspike (excluding flowers); spikes (or panicles) alternate to opposite, 1 per axil, peduncles to 25 mm long, evenly pubescent with flexuose glandular trichomes 0.2–0.7 mm long, rachis pubescent like peduncles; dichasia alternate (i.e., 1 per node), 1-flowered, 1 per axil, sessile. Bracts opposite, triangular to subulate, 1–2.6 (–4) mm long, 0.6–1.4 mm wide, abaxial surface pubescent with antrorsely appressed eglandular trichomes 0.1–0.3 mm long and sometimes with an overstory of glands like those of peduncle/rachis or sometimes nearly glabrous. Bracteoles subulate to lance-subulate, 2.5–5 mm long, 0.6–1 mm wide, abaxial surface pubescent like bracts. Flowers sessile to subsessile (i.e., with peduncles to 1 mm long). Calyx 4-lobed, 7–12 mm long (accrescent in fruit to 12.5 mm long), lobes lanceolate to lance-linear, subequal, 6–9 (–10.5) mm long, 1–1.3 (–1.7) mm wide, widest at base or near middle, abaxially sparsely pubescent with antrorsely appressed eglandular trichomes to nearly glabrous, margin neither thickened nor discolored. Corolla pink to red, (26–) 30–48 mm long, externally pubescent with flexuose to retrorse eglandular trichomes 0.1–0.3 mm long, tube gradually expanded distally, 18–26 mm long, 1.4–2.1 mm in diameter near midpoint, upper lip 12–20 mm long, ± entire, lower lip 11–20 mm long, lobes 2.5–4.2 mm long, 1.7–2 mm wide. Stamens inserted near apex of corolla tube, 14–20 mm long, thecae 1.5–2.8 mm long, subequal to unequal (upper theca longer), subparallel to perpendicular, subequally to unequally inserted (overlapping by up to 2 mm), dorsally glabrous, lacking basal appendages (or lower theca with an inconspicuous appendage to 0.05 mm long); pollen 2-aperturate, apertures flanked on each side by 2–3 rows of insulae. Style 33.5–43 mm long, glabrous, stigma 0.1–0.2 mm long, lobes not evident. Capsule 22–29 mm long, glabrous, stipe 9–13 mm long, head obovoid to ellipsoid, 11–16 mm long. Seeds 4, greenish when young, lenticular (i.e., plano-convex), 5–6.3 mm long, 4–5.5 mm wide, surfaces and margin covered with subconic tubercles to 0.4 mm long, tubercles more prominent and longer on immature seeds, sometimes becoming ± restricted to margin at maturity.

Phenology.— Flowering: January–April, August–September; fruiting: April, August–September, December–January.

Habitat.— Lowland rain forests, tall forests [in a region of tropical broadleaf evergreen forests], along streams; 0–600 m. The lowland forests in which this species occurs are dominated by *Dendropanax arboreus*, *Quararibea funibris*, *Q. yunckeri* ssp. *izabalensis*, *Calophyllum brasiliense* var. *rekoi*, *Phyllanthus austinii*, *Swartzia standleyi*, *Blakea bella*, *Parathesis belizensis*, *Manilkara achras*, *Terminalia nyssaefolia*, *Psychotria chiapensis*, *Pouteria mammosa*, *Sloanea tuerckheimii*, and *Tabermontana chrysocarpa*. Other Acanthaceae occurring in the immediate vicinity of the type collection include: *Aphelandra aurantiaca*, *Justicia breviflora*, *J. fimbriata*, and *Odontonema hondurense*.

Paratypes.— GUATEMALA. **Izabal**: Chocón Machacas, 18 III 2003, *G. Cazali et al. 3200* (BIGU,

USCG); Río Chacón, *H. Johnson 1190* (US); Biotopo Chocón, Cerro Mal Cocinado, 15°47'00"N, 89°50'45"W, 11 IV 2001, *J. Morales 954* (USCG); Montañas de Mico, 7–8 km W of Santo Tomás de Castilla on road to microwave tower, *W. Stevens et al. 25590* (MO, USCG); Livingston, Quebrada Seca, 27 VI 1998, *M. Véliz 98.6198* (BIGU, MO), 1 VIII 1998, *M. Véliz 98.6458* (BIGU); Mpio. Livingston, Río Dulce, Aldea La Libertad, Quebrada Seca, 15°41'52.1"N, 80°04'48.6"W, *M. Véliz & T. Daniel 20600* (BIGU), *20602* (BIGU). **Petén**: La Cumbre, W of KM 140 on Cadenas Rd., *E. Contreras 6183* (F, LL, MO, US); La Cumbre, Pusila, 5 km from La Cumbre bordering Pusila River, 2 km S of the village, *E. Contreras 8890* (LL, MO, US); Los Arcos, Cadenas Rd., on KM 143/144, west, *E. Contreras 9354* (LL, MO, US).

This species is endemic to Guatemala (Izabal, southeastern Petén). The type was collectd from an extensive population (more than 100 plants) in the floodplain of a river. Based on the number of recent collections of this species, and its occurrence in a region of some 1800 sq. km., the species would not appear to be rare or threatened at the present time. Many collectors have noted that corollas are pink; the type has red corollas; and *Cazali et al. 3200* noted yellow flowers.

Because inflorescences of *J. velizii* may be either simple spikes or panicles of spikes, the species does not fit neatly into one of Graham's (1988) infrageneric taxa. If the inflorescence is treated as compound (i.e., a panicle of spicate axes), the species appears to have affinities to her section *Sarotheca* (Nees) Benth. Plants with simple spikes would "key" to her section *Dianthera* subsect. *Saglorithys* (Rizzini) V.A.W. Graham. Pollen like that of *J. velizii* is not known from either of these sections. However, this type of pollen is known from her section *Plagiacanthus* (Nees) V.A.W. Graham, and it was as "peripheral" to this section that she treated *J. inaequalis*. Indeed, collections of *J. velizii* have usually been identified as *J. inaequalis*, and the two species share a number of similarities (e.g., habit, inflorescence type, calyx lobe number, corolla form and color, pollen sculpturing). However, *J. inaequalis* differs from Graham's characterization of section *Plagiacanthus* in several important characters including its 4-lobed calyx and smooth seeds. Thus, the infrageneric affinities of both of these species remain to be determined. They can be disginguished from one another by the characters in the following couplet:

1. Inflorescence peduncles and rachis evenly pubescent with flexuose glands 0.3–0.7 mm long; leaves subcoriaceous; bracts 1–2.6 (–4) mm long, abaxially pubescent with antrorsely appressed eglandular trichomes 0.1–0.3 mm long and sometimes with a sparse overstory of glands like those on peduncles and rachis (rarely nearly glabrous); calyx 7–12 mm long (during anthesis), lobes 6–9 (–10.5) mm long, 1–1.3 (–1.7) mm wide, margins not thickened or discolored; capsule 22–29 mm long; seeds 5.2–6.3 × 4–5.5 mm, surfaces and margin covered with subconic tubercles to 0.4 mm long, tubercles more prominent and longer on immature seeds, sometimes becoming ± restricted to margin at maturity; plants of moist to wet lowland forests at 0–600 m. . . . . *J. velizii*

1. Inflorescence peduncles and rachis glabrous (or very nearly so); leaves membranaceous; bracts 3–5 mm long, abaxially glabrous; calyx 11–18 mm long (during anthesis), lobes 10–17 mm long, 1.5–2.5 mm wide, margins noticeably thickened or discolored; capsule 16–20 mm long; seeds 3.3–3.5 × 2.4–2.5 mm, surfaces and margin covered with low, rounded tubercles to 0.05 mm high; plants of moist to wet lowland, montane, and cloud forests at 450–2400 m . . . . . *J. inaequalis*

Another congener in the region that superficially resembles both *J. inaequalis* and *J. velizii* is the Chiapan endemic *J. tianguensis*. However, it differs from both by its calyx (five-lobed with four large lobes and one small lobe vs. equally four-lobed), bracts (lanceolate to lance-ovate and 1.6–2.5 mm wide vs. triangular to subulate and 0.6–1.4 mm wide), and inflorescence (dichasia/flowers opposite at nodes, the spike not secund vs. dichasia/flowers one per node, the spike secund).

***Justicia viridescens* (Leonard) T.F. Daniel**

RECENT DESCRIPTION.— Daniel (2003).

PHENOLOGY.— Flowering: January, May, September; fruiting: January.

HABITATS.— Lowland rain forests, wet forests, tall perennial forests; near sea level–120 m.

Izabal: *Standley 72948* (holotype of *Megalostoma viridescens* Leonard: F, isotype: US).

Gibson (1974) provided an illustration of this species, which she treated as *Megalostoma viridescens*. Daniel (2003) treated *Megalostoma* as congeneric with *Justicia*, aligned this unusual species with three others from nearby regions of Mexico and Guatemala, and placed all four into a new section (*Megalostoma*) of the genus. *Justicia viridescens* is known only from the moist region around the Bahía de Gálvez near Puerto Barrios, where it has been collected at least five times and as recently as 2009 (e.g., *Daniel et al. 11241*). Some or all of its distributional range appears to be located within one or more protected regions encompassing the Cerro San Gil. Although this species appears to be rare and restricted in its distribution, it can be locally abundant; ca. 30 plants were observed along 100 meters of roadway in 2009.

***Justicia williamsii* T.F. Daniel, stat. et nom. nov.**

Figure 11

Justicia macrantha var. *piliformis* D.N. Gibson, Fieldiana. Bot. 34:70. 1972. TYPE.— GUATEMALA. **Sololá**: above Lake Atitlán, ca. 3–5 km W of Panajachel, 2100 m, mixed forest area on montane slopes, 6–7 December 1963 (flr), *L. Williams et al. 25314* (holotype: F!; isotype: US!).

Arching shrub to 4 m tall. Young stems subterete to subquadrate, ± evenly pubescent with flexuose to retrorse eglandular trichomes 0.4–1.2 mm long. Leaves petiolate, petioles to 10 mm long, blades ovate to elliptic, 27–100 mm long, 12–52 mm wide, 1.8–2.7 times longer than wide, surfaces pubescent (especially along major veins) with flexuose to antrorse eglandular trichomes to ± glabrate, abaxial surface conspicuously "punctate" with dark circular projections 0.05–0.1 mm in diameter, margin entire, ciliate with flexuose to antrorse eglandular trichomes. Inflorescence of axillary pedunculate dichasiate spikes to 20 mm long (including peduncles and excluding flowers) from axils of distal leaves that are sometimes ± reduced in size (see discussion below); spikes opposite, 1 per axil, peduncle of spikes to 11 mm long, evenly pubescent with retrorse eglandular trichomes 0.3–1 mm long, rachis evenly pubescent with retrorse eglandular trichomes 0.3–1 mm long or becoming very sparsely pubescent; dichasia 2 (–3) per spike, alternate, 1 per axil, sessile, 1-flowered. Bracts opposite, linear-elliptic to lance-triangular to triangular, 1–4 mm long, 0.8–1.3 mm wide, abaxial surface pubescent with flexuose to retrorse eglandular trichomes 0.1–0.4 mm long to glabrate. Bracteoles triangular to lance-triangular to ovate, 1.5–2.2 mm long, 0.7–0.9 mm wide, abaxial surface pubescent with erect to flexuose to retrorse eglandular trichomes 0.1–0.3 mm long to glabrate. Flowers sessile to subsessile (i.e., borne on pedicels to 0.5 mm long). Calyx 5-lobed, 5–6 mm long (up to 7 mm long in fruit), lobes lanceolate to lance-ovate, equal, 4–4.8 mm long, 1.3–2 mm wide, abaxially pubescent with erect to flexuose eglandular trichomes 0.1–0.4 mm long to glabrate, margin ciliate with flexuose to erect eglandular trichomes 0.1–0.6 mm long. Corolla red, 50–63 mm long, externally pubescent distally with erect to flexuose eglandular trichomes 0.05–0.3 mm long, glabrous proximally, tube gradually expanded distally, 26–35 mm long, 2.5–3.5 mm in diameter (measured flat) near midpoint, upper lip 23–28 mm long, erose at apex, lower lip 21–28 mm long, 3-lobed, lobes 1.5–3 mm long, 2–3.2 mm wide. Stamens inserted near apex of corolla tube, (16–) 23–27 mm long, exserted from mouth but not extending beyond upper lip, filaments glabrous, thecae 1.9–2.7 mm long, equal in size, parallel, equally to subequally inserted, glabrous, lacking basal appendages; pollen 2-aperturate, apertures flanked on each side by

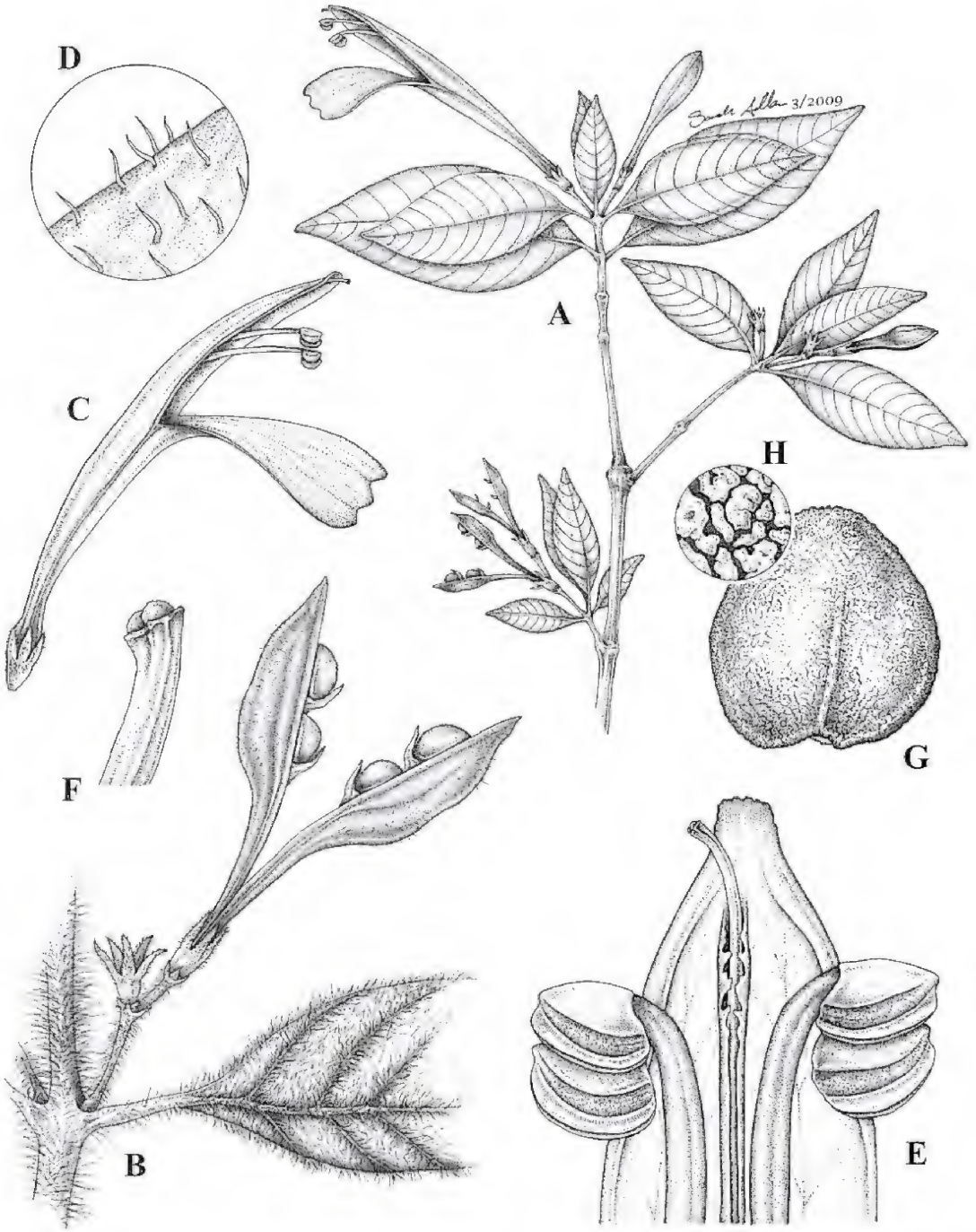


FIGURE 11. *Justicia williamsii* (*Daniel & Barreno 11265*). A. Habit, × 0.66. B. Inflorescence with capsule, × 2. C. Flower, × 1.2. D. Trichomes on external surface of upper lip of corolla, × 30. E. Ventral surface of upper lip of corolla showing style in rugula and distal portions of stamens, × 7.2. F. Distal portion of style with stigma, × 30. G. Seed, × 8. H. Seminal surface, × 35. Drawn by S. Adler.

1–2 rows of ± obscure insulae. Style 51–63 mm long, often decurved near apex, sometimes extended beyond upper lip, proximally glabrous or pubescent with eglandular trichomes, stigma 0.1 mm long, ± equally 2-lobed. Capsules 21–33 mm long, externally ± sparsely pubescent distally with straight to flexuose eglandular trichomes 0.1–0.2 mm long to glabrate, stipe 11–16 mm long, head 11–17 mm long. Seeds sublenticular, broadly ovate to subsquare, 4.2–5 mm long, 3.6–4.1 mm wide, surfaces with a ± prominent longitudinal central ridge and covered with low rounded tubercles that sometimes coalesce and form a network of irregular ridges, margin with similar tubercles and ± erose at apex and base.

Phenology.— Flowering: December–February; fruiting: January–February.

Habitat.— Pine-oak forests, montane slopes; 1740–2100 m.

Sololá: *Daniel & Barreno 11265* (BIGU, BR, CAS, F, K, MICH, MO, US).

Gibson (1972) described this taxon as a variety of *J. macrantha* based on a single collection from southwestern Guatemala. She noted that it differed from the nominate variety by its pubescence, shorter and broader leaves, shorter inflorescences, and lanceolate and acute calyx lobes. I agree with her that the plant appears different from typical *J. macrantha* in most of these (and other characters), and that its flowers superficially resemble those of that species. Based on the number and types of known differences, however, I propose this taxon as a distinct species of *Justicia* that appears to be endemic to Guatemala, honors the collector of the type, and can be distinguished from *J. macrantha* by the characteristics in the following couplet:

1. Young stems pubescent with eglandular trichomes; inflorescence of dichasiate spikes to 20 mm long; dichasia sessile; calyx 5–6 mm long during anthesis, lobes 4.2–4.8 mm long; corolla red tinged with orange and yellow at mouth, externally pubescent distally with eglandular trichomes . . . . . *J. williamsii*
1. Young stems glabrous; inflorescence of dichasiate thyrses or panicles to 60 mm long; dichasia pedunculate, peduncles 3–15 mm long; calyx 4–5 mm long during anthesis, lobes 3.2–3.8 mm long; corolla orange (often with some pink as well), externally glabrous . . . . . *J. macrantha*

Descriptions of the previously unknown capsules and seeds are provided here for the first time. As in many taxa of Acanthaceae, the inflorescence is sometimes modified. In some instances, what superficially appears as an axillary spike is an axillary branch with reduced leaves bearing spikes in their axils. In such cases, the axillary inflorescence might be interpreted as a subleafy panicle of spikes in the leaf axils of the main shoots.

Daniel & Barreno 11265, *Barreno 810* (BIGU), and *Barreno 832* (BIGU) were collected in 2009 near the type locality nearly fifty years after the only previous collection of the species by Williams et al. In 2009 ca. 15 plants were evident in a limited region between one and three kilometers west and upslope from Panajachel toward Sololá. The species appears to be restricted in its range, but persisting on steep slopes. It is not known whether its range overlaps with any of the protected areas in the vicinity of Lago de Atitlán. Although its conservation status remains unknown, this species would appear to be both rare and possibly at risk from local agricultural and highway maintenance activities.

***Lepidagathis alopecuroidea* (Vahl) R.Br. ex Griseb.**

Recent Description.— Daniel (1995b).

Phenology.— Flowering: January–April; fruiting: March–April.

Habitats.— Lowland rain forests, montane forests, wet and wooded ravines, wet pastures, along streams, moist thickets, disturbed sites (e.g., agricultural fields); 100–1400 m.

Alta Verapaz: *Steyermark 44159* (F). **Izabal**: *Daniel et al. 11243* (BIGU, CAS, MO). **Petén**: *Contreras 2156* (LL).

Gibson (1974) treated this species as *Teliostachya alopecuroidea* (Vahl) Nees, a nomenclatural synonym (Daniel 1995b).

***Lepidagathis guatemalensis* (Donn. Sm.) Kameyama**

RECENT DESCRIPTION.— Acosta C. and Saynes V. (2006).

PHENOLOGY.— Flowering: January–March; fruiting: February–March.

HABITATS.— Wooded ravines, moist thickets, dry thickets; 720–1300 m.

Escuintla: *Standley 89504* (F, US). **Guatemala**: *Kellerman 6728* (F, US). **Santa Rosa:** *Heyde & Lux 4382* (holotype of *Lophostachys guatemalensis* Donn. Sm.: US; isotypes: A, CAS, GH, K, M, MO, US).

This species was treated by Gibson (1974) and others as *Lophystachys guatemalensis*. Under the latter name, it was illustrated in Gibson (1974). Kameyama (2008) discussed the inclusion of *Lophostachys* in *Lepidagathis*. The species also occurs in El Salvador, and was recently reported from southern Mexico (Acosta C. and Saynes V. 2006).

***Louteridium donnell-smithii* S. Wats.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: December–April; fruiting: December–May.

HABITATS.— Lowland rain forests, wet mixed forests, cloud forests, moist forests, tall forests, second growth forests, ramonales, moist thickets, along streams; 30–1600 m.

LOCAL NAMES.— "Oxox ce'" (*Williams & Wilson 40437*; Quecchí name); "tabaco silvestre" (*Contreras 5510*); "vejiga" (*Standley 91236*).

Alta Verapaz: *von Tuerckheim 856* (holotype: US; isotypes: GH, NY, US): *Williams et al. 40323* (F). **Baja Verapaz**: *Williams et al. 43563* (F, MICH). **El Progreso**: *Steyermark 43768* (F, MICH, US). **Huehuetenango**: *Steyermark 49180* (F, US). **Izabal**: *Gregory 612* (CAS, F, US). **Petén**: *Daniel & Véliz 11255* (BIGU, CAS, K, MICH, MO). **Zacapa**: *Steyermark 42400* (F, US).

Gibson (1974) and Daniel (1995b) both noted variation in the color of corollas of this species. Three recent collections from Alta Verapaz exemplify this variation: *Daniel & Véliz 11337* (BIGU, CAS, K, MO) from lowland moist forest (670 m) had creamy yellow (sometimes with maroon veins) corollas that appeared to be primarily nocturnal (i.e., they were falling in the early morning); *Daniel et al. 11356* (BIGU, CAS, K, MO) from cloud forest (1350 m) had dirunal (i.e., not falling by 13:00 hours) and maroon-chestnut corollas that were observed to be visited by hummingbirds; and *Daniel et al. 11335* was cultivated in Cobán (1230 m) and had greenish brown corollas that were nocturnal (i.e., collected with fresh flowers after dark).

***Louteridium purpusii* Brandegee**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: October–March; fruiting: January–March.

HABITATS.— Moist forests, wet and wooded ravines, along streams; 1300–2000 m.

Quezaltenango: *Standley 86726* (F). **San Marcos**: *Steyermark 37501* (F).

Louteridium mexicanum (Baill.) Standl., which name was used by Gibson (1974) and Parker (2008) for this species in Guatemala, is not known from the country, but it occurs in several states of southern Mexico (Daniel 1995b). *Louteridium chartaceum* Leonard, which was included in the *Flora of Guatemala* by Gibson (1974) from Belize, remains known only from the latter country.

***Mendoncia guatemalensis* Standl. & Steyerm.**

Recent Description.— Daniel (1992).

Phenology.— Flowering: unknown; fruiting: July.

Habitat.— Dense forests; 150–200 m.

Local name.— "Ciruela de paso sylvestre" (*Steyermark 49270*).

Huehuetenango: *Steyermark 49270* (holotype: F; isotype: NY).

This species is rarely collected in Guatemala (the type is from the Sierra de los Cuchumatanes), but is now also known by numerous collections from Mexico and Honduras (Daniel 1992, 2005).

***Mendoncia lindavii* Rusby, Mem. Torrey Bot. Club 4:241. 1895. Type.**— BOLIVIA. **Cochabamba**: Yungas, 1890, *M. Bang 532* (lectotype, designated here, see discussion below: NY, photo!; isolectotypes: BM, US!).

Mendoncia belizensis Standl., Field Mus. Nat. Hist., Bot. Ser. 11:142. 1932. **Type.**— BELIZE. **Stann Creek**: 19 Mile Stann Creek Valley, 500 ft. alt., mountain side in dense forest shade, 16 Jun 1932, *W. Schipp 961* (holotype: F!; isotypes: MICH! MO!).

Perennial vines. Young stems ± quadrate, densely and evenly pubescent with light brown to golden antrorse to antrorsely appressed or distally pointed eglandular trichomes 1.5–3.5 mm long. Leaves petiolate, petioles to 14 mm long, blades ovate-elliptic to elliptic, 59–120 mm long, 18–50 mm wide, 2–2.9 times longer than wide, acuminate at apex, rounded to acute at base, surfaces pubescent with antrorse eglandular trichomes. Dichasia alternate or opposite in axils of leaves, 1–2 (–4) per axil, 1-flowered, pedunculate, peduncles to 45 mm long, pubescent with spreading-flexuose eglandular trichomes 2–4.5 mm long (hirsute). Bracteoles ovate-lanceolate, 25–40 mm long, 7.5–11 mm wide, 3.3–4.4 times longer than wide, widest near base, sometimes slightly curved, rounded at base, acute-apiculate at apex, apiculum 1–3 mm long (obscured by pubescence), abaxial surface and margin hirsute. Calyx a ± rigid entire ± flaring annular or cupular ring surrounding nectar disc, 0.5–2.5 mm high. Corolla red, 44–54 mm long, externally glabrous, tube 42–44 mm long, narrow proximal portion 20–25 mm long, ± abruptly expanded into throat, throat 17–22 mm long, 5–6.7 mm in diameter, limb (8–) 10–13.5 mm in diameter, upper lip 5.5–6 mm long, lobes 4.8–5 mm long, 3.5–4 mm wide, lower lip 5–7.5 mm long, lobes 4.5–7.5 mm long, 3–4.3 mm wide. Stamens 10–12 mm long, thecae 9–10 mm long, with an apical projection (sometimes recurved) 0.5–0.7 mm long and a basal cluster of papilla like trichomes 0.1–0.2 mm long; pollen 5-brevicolpate. Style 22–32 mm long, glabrous, stigma ± equally 2-lobed, lobes 0.2–0.4 mm long. Drupe blackish, ellipsoid, 18–22 mm long, 9–13 mm in diameter, surface minutely glandular-punctate and pubescent with erect to flexuose eglandular trichomes 0.1–0.4 mm long.

Phenology.— Flowering: April–May; fruiting: April–July.

Habitats.— Wet forests, mesophytic forests with elements of tall forests; 20–750 m.

Alta Verapaz: *Martínez S. et al. 22948* (CAS, HAJB, MO). **Izabal**: *Standley 72603* (F).

Three Bolivian collections were cited by Rusby (1895) in the protologue: *Bang 532* (see above); La Paz: Tipuani-Guanai, Dec 1892, *M. Bang 1707* (BM, MO, NY, US!); and La Paz: Mapiri, *Rusby 2405* (BM, NY, US!). Although the herbaria of deposit were not noted for any of these, various herbaria in which they are located were cited by Wasshausen and Wood (2004). Wasshausen and Wood (2004) noted that *Bang 532* is the type and that the specimen at NY is the holotype. Because syntypes were cited in the protologue, there cannot be a holotype for this species. Wasshausen and Wood's indication of *Bang 532* at NY as the "holotype" would not constitute lectotypification for this name according to Article 9.21 of the International Code of Botan-

ical Nomenclature (McNeill et al. 2006). However, Leonard's (1951:15) earlier indication of "type collected at Yungas, Bolivia, 1890, by Miguel Bang, No. 532," just might. Leonard (1951) indicated that an "isotype" of this collection was at US and that duplicates of *Bang 1707* at US were paratypes. Although Leonard (1951) did not indicate which specimen (Article 9.2 indicates that a lectotype is a specimen or illustration, and thus not a collection of multiple specimens) he thought was the "holotype," his annotations of one of the two specimens of *Bang 532* at NY as the "type" in 1926 and as the "holotype" in 1961, in combination with his 1951 publication that indicates the type collection might be considered as fulfilling the requirements of the Code for lectotypification. If they do not, then *Bang 532* at NY (NYBG 00278379, ex Columbia College Herbarium) is herewith designated as lectotype of *Mendoncia lindavii*. As obviously understood by both Leonard (1951) and Wasshausen and Wood (2004), the first set of Bang's specimens used by Rusby (1893) is at Columbia College (now at NY), where he was employed. (Indeed, labels on Bang's specimens note that they were distributed by Britton and Rusby from the herbarium at Colombia College.) Because all three syntypes pertain to *M. lindavii* as understood here, this choice is a logical one for the type. Although the lectotype is a reasonably complete specimen, the isolectotype at NY (NYBG 00423928, ex College of Pharmacy Herbarium) is equally or perhaps even more complete. Illustrations of the species were provided by Gibson (1974) and Wasshausen and Wood (2004). A species described from Belize, *M. belizensis* Standl., has been treated as conspecific with *M. lindavii* (Gibson 1974; Daniel 1997a).

Pollen of *Mendoncia* (Fig. 9) is distinctive among that of Guatemalan Acanthaceae by its five short colpi (Daniel 1998) and interapertural surface ornamentation (finely rugulate, the rugulae microverrucate).

***Mendoncia retusa* Turrill**

RECENT DESCRIPTIONS.— Daniel (1992, 1995b).

PHENOLOGY.— Flowering: August–October; fruiting: October–November.

HABITATS.— Tall perennial forests, short forests, ramonales, corozales; 120–300 m.

Alta Verapaz: *Contreras 7959* (LL, MO, US). **Izabal**: *Martínez S. et al. 23699* (MO, USCG). **Petén**: *Contreras 6256* (F, LL, MO, US). **Sololá**: *Shannon 90* (US).

***Odontonema albiflorum* Leonard**

RECENT DESCRIPTIONS.— Daniel (1995b, 1995c).

PHENOLOGY.— Flowering: throughout the year; fruiting: throughout the year.

HABITATS.— Lower montane rainforest, tall perennial forests, subdeciduous forests, zapotales, thickets, along streams, disturbed sites (e.g., clearings); 0–1600 m.

Alta Verapaz: *von Tuerckheim 7937* (holotype: US; isotype: US). **Baja Verapaz**: *Pittier 152* (US). **Chimaltenango**: *Johnson 1840* (F). **Huehuetenango:** *Cardona & Morales 217* (USCG). **Izabal**: *Steyermark 41648* (F, LL, US). **Petén**: *Tún Ortiz 1436* (DUKE, F, MO). **Quiché**: *Morales & Pérez 4607* (USCG).

Gibson (1974) reported the species from the department of Guatemala, but no collections from there were located during this study.

***Odontonema callistachyum* (Schlecht. & Cham.) Kuntze**

RECENT DESCRIPTIONS.— Daniel (1995b, 1995c), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: January–August; fruiting: April, July.

HATITAT.— Wet forests, cloud forests, tall forests, mixed forests, moist to wet thickets; 170–2000 m.

Alta Verapaz: *von Tuerckheim 740* (holotype of *Thyrsacanthus geminatus* Donn. Sm.: US; isotypes: F, G, GH, K, M, MO, NY, P, UPS, US). **Baja Verapaz**: *Williams et al. 43391* (F). **Huehuetenango**: *Steyermark 49383* (F). **Izabal**: *Contreras 10033* (LL, MO, US). **Petén**: *Contreras 10443* (F, LL, MO, US).

Gibson (1974) treated this species in a very broad sense that encompassed several previously recognized taxa. Baum (1982) and Daniel (1995c) provided characters to distinguish some of these from *O. callistachyum*. The following key can be used to distinguish all Guatemalan *Odontonema*.

1. Corolla red, pinkish, or purplish.
   2. Corolla pinkish or purplish.
      3. Corolla pinkish; cauline trichomes (if present) 0.05–0.2 mm long; inflorescence rachis glabrous or pubescent with inconspicuous trichomes to 0.1 (–0.3) mm long; dichasia borne on peduncles 2–32 mm long; pedicels glabrous ..... *O. steyermarkii*
      3. Corolla purplish to pinkish; cauline trichomes (if present) 0.2–0.7 mm long; inflorescence rachis densely pubescent with trichomes 0.2–0.6 mm long; dichasia sessile (rarely borne on peduncles to 2 mm long); pedicels pubescent ..... *O. callistachyum*
   2. Corolla red.
      4. Rachis nearly glabrous or pubescent with antrorse to crinkled-appressed trichomes either disposed in lines or ± evenly disposed; dichasia sessile, often whorled at inflorescence nodes. *O. tubaeforme*
      4. Rachis evenly pubescent with erect to flexuose-antrorse eglandular trichomes; dichasia borne on peduncles to 25 mm long, opposite at inflorescence nodes . . . *O. cuspidatum*
1. Corolla entirely yellow or pale blue to white with purplish markings on lower lip.
   5. Corolla pale blue to white with purplish markings on lower lip; dichasia mostly whorled (opposite proximally) at inflorescence nodes ..... *O. albiflorum*
   5. Corolla entirely yellow; dichasia opposite at all inflorescence nodes.
      6. Corolla 22–32 mm long, externally glabrous; dichasia pedunculate, 3–many-flowered; pedicels glabrous; thecae 2.6–3.1 mm long; capsule glabrous ..... *O. glabrum*
      6. Corolla 14–26 mm long, externally puberulent; dichasia sessile, 1(–3)-flowered; pedicels puberulent; thecae 1.3–1.8 mm long; capsule puberulent ..... *O. hondurense*

***Odontonema cuspidatum* (Nees) Kuntze**

RECENT DESCRIPTIONS.— Daniel (1995b, 1995c), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: May, October; fruiting: unknown.

HABITAT.— Unknown; 800–1500 m.

LOCAL NAME.— "Hoja de tinta" (*Aguilar 22*).

Guatemala: *Aguilar 22* (F); *Aguilar 165* (F). **Izabal**: *Castillo s.n.* 15-X–2004 (BIGU).

This species was treated by Gibson (1974) as conspecific with *O. callistachyum*. Daniel (1995c, 2005) discussed its distinctions from that species and its distribution in Central America. The species is only tentatively regarded as native to Guatemala. Aguilar's collections in 1938–1939 from "near Finca La Aurora" (*22*) and from an unspecified locale in the Dept. of Guatemala (*165*) could represent one or more cultivated (or naturalized) occurrence(s) rather than native occurrences. Other collections from Guatemala were noted to have been cultivated. Guatemalan plants resemble collections of this species from other countries. In Chiapas plants occur in lowland rain forests, montane rain forests, and cloud forests.

***Odontonema glabrum* Brandegee**

Recent descriptions.— Daniel (1995b, 1995c).

Phenology.— Flowering: February–April; fruiting: unknown.

Habitat.— Wooded ravines; 620–800 m.

Escuintla: *Standley 63875* (holotype of *O. galbanum* Leonard: US; isotype: F). **Retalhuleu**: *Donnell-Smith 2695* (US). **Sacatepéquez**: *Standley 65014* (F, US). **San Marcos**: *Steyermark 52322* (F).

***Odontonema hondurense* (Lindau) D.N. Gibson, Fieldiana, Bot. 34:74. 1972**. *Diateinacanthus hondurensis* Lindau, Bull. Herb. Boissier, ser. 2, 5:369. 1905. **Type.**— HONDURAS. **Atlántida**: along trail near Bolet's Plantation, Puerto Sierra [=Tela, fide A. Molina R., pers. comm.], 20 Jan 1903, *P. Wilson 129* (holotype: NY, image at http://sweetgum.nybg.org/common/imagedisplay.php?irn=76310).

Odontonema paniculiferum Blake, Contr. Gray Herb. 52:104. 1917. **Type.**— BELIZE. **Belize**: near manatee Lagoon, 8 Jan 1906, *M. Peck 278* (holotype: GH! isotypes: F, K).

Perennial herbs to shrubs to 3.6 m tall. Young stems subquadrate to ± flattened, glabrous to sparsely puberulent with erect eglandular trichomes < 0.1 mm long. Leaves petiolate, petioles to 15 mm long, blades elliptic to obovate, 45–180 mm long, 14–85 mm wide, 2–4.3 times longer than wide, acute to acuminate to subapiculate at apex, acute at base, surfaces glabrous, margin entire to ± sinuate. Inflorescence of terminal pedunculate openly branched panicles of dichasiate racemes, peduncles to 45 mm long, puberulent like young stems or with trichomes denser and inconspicuously glandular punctate, inflorescence bracts (subtending branches) linear to lanceolate to subulate to triangular-subulate, 0.9–3 mm long, 0.4–0.8 mm wide, rachis nearly glabrous or puberulent like peduncles (and glandular punctate); dichasia (alternate to) opposite, sessile, 1(–3)-flowered, 1 per axil. Bracts opposite, triangular, 0.3–1 mm long, 0.3–0.5 mm wide, abaxial surface puberulent with erect eglandular trichomes < 0.1 mm long. Bracteoles sometimes inconspicuous, triangular, 0.2–0.7 mm long, 0.1–0.4 mm wide, abaxial surface pubescent like bracts. Flowers heterostylous, pedicellate, pedicels 2–12 mm long, puberulent. Calyx 1.9–3.5 mm long, lobes triangular-lanceolate to lanceolate, 1.2–2.5 mm long, abaxially glabrous to puberulent. Corolla yellow, 14–26 mm long, externally puberulent with erect eglandular and glandular (sometimes sparse) trichomes up to 0.1 mm long, tube 10–18 mm long, proximal portion cylindric to conic for 4–7 mm thence gradually expanded distally toward limb, limb 8.5–15 mm in diameter, upper lip 3.5–8 mm long, 2-lobed, lobes 3–5 mm long, lower lip 3.5–8 mm long, 3-lobed, lobes 3–7 mm long, 2.5–4.8 mm wide. Stamens inserted near or proximal to midpoint of corolla tube, filaments proximally pubescent with eglandular trichomes, thecae 1.3–1.8 mm long, pin stamens included in corolla tube, 4–6.5 mm long, thrum stamens exserted from mouth of corolla, 11–15 mm long; staminodes 0.6–0.7 mm long, pubescent; pollen 3-colporate, 6-pseudocolpate. Style sparsely pubescent proximally with eglandular trichomes, pin styles exserted from mouth of corolla, 13.5–21 mm long, thrum styles included in corolla tube, 8–10 mm long, stigma lobes equal to subequal, 0.1–0.2 mm long. Capsule 16–20.5 mm long, externally puberulent (at least distally) with inconspicuous sessile to stipitate glandular (and sometimes eglandular as well) trichomes < 0.1 mm long, stipe 7–10 mm long, head ellipsoid to obovoid, with a medial constriction, 8–11 mm long. Seeds lenticular, 2.5–4 mm long, 2–3 mm wide, surfaces and margin covered with rounded to conical tubercles.

Phenology.— Flowering: December–April, September; fruiting: January–April.

Habitats.— Lowland rain forests, tall perennial forests, short forests, secondary forests, corozales, along streams; 3–165 (–1200) m.

Izabal: *Daniel et al. 11258* (BIGU, CAS, K, MO, US). **Petén**: *Contreras 10532* (F, LL, MO, US).

Differences in relative lengths of the stamens and styles among collections reveal *O. hondurense*, like all other species of *Odontonema* from Guatemala, to be heterostylous (i.e., distylous). Daniel (2005) discussed some of the morphological variation encountered in the species. Label data on *Martínez S. et al. 23669* from Izabal indicates that the plant was a tree to 10 m; if accurate, this habit would be unusual for the genus. Flowers of a collection of *O. hondurense* from Belize (*Shipp 222*) were noted to have been visited by hummingbirds. Gibson (1974) noted the occurrence of this species in Chiquimula, possibly based on *Watson 168* from "eastern portions of Vera Paz and Chiquimula."

***Odontonema steyermarkii* Leonard, J. Wash. Acad. Sci. 33:71. 1943.** TYPE.— GUATEMALA. **Quezaltenango**: along road between Finca Pirineos and Calahuaché, 1200–1300 m, 27 Jan 1940, *J. Steyermark 35020* (holotype: F!; isotype: US!).

Shrubs (sometimes clambering) to 3 m tall. Young stems quadrate-sulcate to subquadrate, ± 2-fariously pubescent with flexuose to antrorse eglandular trichomes 0.05–0.2 mm long or ± glabrous. Leaves petiolate, petioles to 15 mm long, blades elliptic, 125–290 mm long, 43–106 mm wide, 2.4–4 times longer than wide, acuminate at apex, attenuate at base, surfaces sparsely pubescent (at least on major veins) with eglandular trichomes or ± glabrous. Inflorescence of terminal usually branched (at least basally) dichasiate thyrses to 6.3 dm long, inflorescence bracts (subtending branches) subfoliose to linear to lance-subulate (e.g., reduced to 5.5 × 1.2 mm), rachis glabrous or with inconspicuous antrorse to distally pointing eglandular trichomes to 0.1 (–0.3) mm long, trichomes (when present) irregularly disposed on some portions of rachis; dichasia opposite, pedunculate, mostly 3–many-flowered, ± expanded (i.e., secondary peduncles usually present), peduncles 2–32 mm long, glabrous. Bracts opposite, lance-subulate to subulate-acicular, 2–5 mm long, 0.4–1.1 mm wide, abaxial surface glabrous to sparsely pubescent with distally pointing eglandular trichomes to 0.2 mm long. Bracteoles subulate to subulate-acicular, 1.6–3 mm long, 0.3–0.7 mm wide, abaxial surface glabrous or pubescent like bracts; secondary bracteoles similar to bracteoles except smaller. Flowers heterostylous, pedicellate, pedicels 2–6 mm long, glabrous. Calyx 2–5 mm long, lobes lance-subulate, 1.9–4 mm long, abaxially glabrous or pubescent like bracts. Corolla pinkish, 21–30 mm long, externally glabrous (margins of lobes often ciliate), tube 15–24 mm long, ± abruptly expanded near midpoint into a throat, narrow proximal portion of tube 8–12 mm long, 1.2–1.9 mm in diameter near midpoint, throat 7–12 mm long (shorter or longer than narrow proximal portion), 3–4.6 mm in diameter near midpoint, upper lip 5–7 mm long, 2-lobed, lobes 1.5–2 mm long, lower lip 4–7.5 mm long, 3-lobed, lobes 4–7 mm long, 1.8–3.5 mm wide. Stamens inserted near base of corolla throat, filaments glabrous, thecae 2–3 mm long, pin stamens included in corolla tube, 7 mm long, thrum stamens exserted from mouth of corolla, 12–14 mm long; staminodes 0.8–1 mm long, glabrous; pollen 3-colporate, 6-pseudocolpate. Style sparsely pubescent with erect eglandular trichomes to 0.1 mm long, pin styles exserted from mouth of corolla, 20–22 mm long, thrum styles included in corolla tube, 14–15 mm long, stigma 0.1–0.2 mm long, ± equally 2-lobed (or lobes barely distinct). Ovary glabrous. Capsule and seeds unknown.

PHENOLOGY.— Flowering: December–April; fruiting: unknown.

HABITATS.— Riparian forests, moist to wet thickets, along streams; 240–1200 m.

LOCAL NAME.— "Palo de agua" (*Standley 88771*).

Escuintla: *Standley 89559* (F, US). **Quezaltenango**: *Skutch 2028* (F, US). **Retalhuleu**: *Standley 88771* (F). **Sacatepéquez**: *Standley 88948* (F). **San Marcos**: *Shannon 346* (US). **Suchitepéquez**: *Standley 88892* (F).

Although *Odontonema steyermarkii* was included, along with several other species, within a greatly expanded concept of *O. callistachyum* by Gibson (1974), this distinctive Guatemalan endemic can be distinguished from others in the country by the combination of its pedunculate and opposite dichasia, glabrous (or inconspicuously pubescent) rachises, and pinkish corollas. Among Guatemalan collections corollas are described as "dirty pink," "dull pink," "pale red," and "salmon-pink." Notes on the type indicate that corollas were pale buff along the tube and lilac on the lobes; in other features, the type conforms to other collections of this species.

Baum (1982) cited *White 5204* (MICH) from Chimaltenango as pertaining to this species. I was unable to locate that collection at MICH, and the species is otherwise unknown from that department.

The species is known by at least 10 collections from six departments and was last collected in 1987 (*Croat & Hannon 63400*). Most collections were made prior to 1960, and the conservation status of the species remains unknown.

***Odontonema tubaeforme* (Bertol.) Kuntze**

RECENT DESCRIPTIONS.— Daniel (1995b, 1995c).

PHENOLOGY.— Flowering: throughout the year; fruiting: December–May.

HABITATS.— Lowland rain forests, montane rain forests, cloud forests, moist forests, tall forests, short forests, dry to wet thickets, ramonales, along streams; 50–2800 m.

LOCAL NAME.— "Coralillo" (*Stricker 357*).

Alta Verapaz: *Standley 91771* (F, US). **Chimaltenango**: *Morales R. 1285* (F). **Escuintla:** *Velasquez s.n.* (holotype of *Justicia tubaeformis* Bertol.: BOLO). **Izabal**: *Daniel et al. 11238* (BIGU, CAS, MO). **Petén**: *Contreras 1018* (F, MO). **Quezaltenango**: *Steyermark 33431* (F). **Retalhuleu**: *Standley 87881* (F). **Sacatepéquez**: *Molina R. 15434* (F). **San Marcos**: *Steyermark 37318* (F). **Santa Rosa**: *Heyde & Lux 4553* (F, US). **Sololá**: *Quedensley 4896* (BIGU). **Suchitepéquez**: *Standley 66935* (F). **Totonicapán**: *Williams et al. 23974* (F, LL, US).

Gibson (1974) included this species within her broad concept of *O. callistachyum*. Several plants annotated by Baum as *O. glaberrimum* (M.E. Jones) V.M. Baum from Petén, Guatemala (e.g., *Contreras 6688* at LL, MO, US, and *Lundell 1646* at LL) pertain to *O. tubaeforme*.

This species shows considerable morphological variation in portions of Central America (e.g., El Salvador, see Daniel 2001). Among plants from Guatemala: bracts along the inflorescence rachis are often, but not always, whorled; pubescence of the rachis varies from nearly glabrous to pubescent in lines with antrorse eglandular trichomes to pubescent with ± evenly disposed trichomes that are crinkled-appressed; and all plants have red corollas (although *Contreras 6688* from Petén is noted to have "pinkish-red" corollas). Thus, plants in Guatemala show variation similar to those in El Salvador, as opposed to the general lack of variation evident among Mexican and Honduran plants.

***Poikilacanthus macranthus* Lindau**

RECENT DESCRIPTIONS.— Daniel (1991b, 1995b).

PHENOLOGY.— Flowering: January–August; fruiting: January–April.

HABITATS.— Lower montane rain forests, moist forests, tall forests, moist thickets, slopes, ravines; 345–1800 m.

LOCAL NAME.— "Sacatillo chiltet" (*Steyermark 33407*).

Alta Verapaz: *Johnson 523* (holotype of *P. setiferus* Standl. & Steyerm.: F; isotype: US). **Baja Verapaz**: *Lundell & Contreras 19596* (LL, MO, US). **Huehuetenango**: *Steyermark 49453* (F, US). **Izabal**: *Daniel et al. 11245* (BIGU, CAS, K, MO, US). **Quezaltenango**: *Standley 68443* (F). **San**

Marcos: *Steyermark 37405* (F, US). **Sololá**: *Emeterio 797* (UVAL). **Suchitepéquez**: *Steyermark 46607* (F, US).

Gibson (1974) treated *Poikilacanthus setiferus* as distinct from *P. macranthus*. Daniel (1995b) treated them as conspecific. A syntype of *P. macranthus* (*Bernoulli & Cario 2301* at B, destroyed) was collected from an unknown department in Guatemala. Typification of this species was discussed by Daniel (1995b). The three species of Guatemalan *Poikilacanthus* can be distinguished by the following key:

1. Bracts pubescent with eglandular trichomes only; corollas pinkish purple, 55–75 mm long, externally pubescent with glandular (and sometimes also with a few eglandular) trichomes ..... *P. macranthus*
1. Bracts pubescent with glandular and eglandular trichomes; corollas red, 35–42 mm long, externally pubescent with eglandular trichomes only.
   2. Leaves subsessile (petioles to 1 mm long), blades rounded to acute at base; bracts 4–6 mm long, 1.7–2.5 mm wide; calyx 9–12 mm long during anthesis, abaxially glabrous; lobes of lower lip of corolla 1–1.5 mm long; anther thecae 1.5–1.8 mm long, those of a pair oriented perpendicular, superposed (gap 0.2–0.9 mm), lacking basal appendages . . *P. pansamalanus*
   2. Leaves petiolate (petioles to 15 mm long), blades attenuate at base; bracts 7–10 mm long, 2.6–4.2 mm wide; calyx 6.8–8 mm long during anthesis, abaxially pubescent; lobes of lower lip of corolla 2–3 mm long; anther thecae 2–2.9 mm long, those of a pair subparallel, unequally inserted (overlapping by 1.2–1.5 mm), each with an inconspicuous basal appendage to 0.2 mm long ..... *P. skutchii*

***Poikilacanthus pansamalanus* (Donn. Sm.) D.N. Gibson, Fieldiana, Bot. 34:75. 1972.** *Beloperone pansamalana* Donn. Sm., Bot. Gaz. (Crawfordsville) 13:75. 1888. **Type**.— GUATEMALA. **Alta Verapaz**: Pansamalá, 3800 ft., Oct. 1885 *H. von Tuerckheim 732* (holotype: US!; isotype: GH). Although two dates ("Oct., 1885, Sept., 1886") are noted in the protologue, the label of the presumed holotype at US states only the date in October 1885. It is possible that another gathering attributed to *von Tuerckheim 732* was made in September 1886 (and perhaps even labeled so), but because the presumed holotype cites only a single date, this name would appear to be validly published.

Perennials. Young stems quadrate to quadrate-sulcate, 2-fariously pubescent with flexuose to antrorse eglandular trichomes 0.1–0.3 mm long, trichomes conspicuously multi-celled with maroon septae. Leaves subsessile (petioles to 1 mm long), pair at a node either anisophyllous or ± isophyllous (at least some pairs anisophyllous on branches), blades ± coriaceous, elliptic, 7.5–30 mm long, 4.5–14 mm wide, 1.6–2.3 times longer than wide, rounded to acute at base, acute to subacuminate at apex, adaxial surface glabrous, abaxial surface sparsely pubescent along midvein with eglandular trichomes, margin entire. Inflorescence of terminal spikelike axes bearing 1–3 dichasia; dichasia 1 per axil of distal leaf or bract, sessile, 1-flowered. Bracts spatulate to cuneate to deltate, 4–6 mm long, 1.7–2.5 mm wide, abaxial surface and margin distally pubescent with erect to flexuose mostly glandular trichomes 0.1–0.2 mm long. Bracteoles spatulate to cuneate to deltate, 6–7 mm long, 1.5–2 mm wide, abaxial surface and margin pubescent like bracts. Flowers sessile. Calyx 9–12 mm long, lobes lanceolate, 8–10.5 mm long, 1–1.2 mm wide, abaxially glabrous, margin ciliate with flexuose to antrorse eglandular trichomes to 0.5 mm long. Corolla red, 37–39 mm long, externally pubescent with flexuose eglandular trichomes 0.1–0.5 mm long, tube 22–25 mm long, gradually expanded distally, 2.7–3 mm in diameter near midpoint, upper lip rugulate, 13–15 mm long, 2-fid at apex, lower lip 13–15 mm long, lobes 1–1.5 mm long, 1.5–2 mm wide. Stamens inserted

near apex of corolla tube, 14 mm long, filaments glabrous distally, thecae 1.5–1.8 mm long, equal to subequal in length, perpendicular, superposed (gap 0.2–0.9 mm), glabrous, lacking basal appendages; pollen 5 or 6[?]-porate, insulae discrete or contiguous (but not sharing common walls). Style 33 mm long. Capsule unknown.

Phenology.— Flowering: April, Ocotber; fruiting: unknown.

Habitats.— Forests; ca. 1150 m.

Alta Verapaz: *Donnell-Smith 1683* (US).

This species is endemic to Guatemala (Alta Verapaz) and is apparently known only from the two late nineteenth century collections (both from Pansamalá) noted above. Attempts to relocate this species in a remnant cloud forest in the region of Pansamalá in January 2010 were not successful, and it remains unknown whether the species still persists.

***Poikilacanthus skutchii* D.N. Gibson, Fieldiana, Bot. 34:75. 1972. Type.**— GUATEMALA. **Quezaltenango**: Volcán Zunil, 2400 m, 4 Aug 1934, *A. Skutch 936* (holotype: F!; isotypes: A, US!).

Shrubs to 2 m tall. Young stems quadrate-sulcate to ± flattened, 2-fariously (to ± evenly) pubescent with flexuose to retrorse eglandular trichomes 0.2–0.3 mm long, trichomes conspicuously multi-celled with dark bands. Leaves petiolate (petioles to 15 mm long), pair at a node either anisophyllous or ± isophyllous (at least some pairs anisophyllous on branches), blades ± membranaceous, elliptic to obovate, 21–81 mm long, 11–50 mm wide, 1.9–3.9 times longer than wide, attenuate at base, acute to abruptly acuminate at apex, surfaces pubescent along major veins only, margin entire. Inflorescence of terminal pedunculate dichasiate spikes to 38–46 mm long (including peduncle and excluding flowers); peduncles to 9 mm long, pubescent with eglandular (and usually glandular as well) trichomes; rachis ± evenly pubescent with flexuose to retrorse glandular and eglandular trichomes 0.1–0.3 mm long; dichasia opposite (or sometimes occurring in only one axil at proximalmost node), sessile, 1-flowered. Bracts opposite, obovate-spatulate to obovate to deltate, 7–10 mm long, 2.6–4.2 mm wide (proximalmost pair sometimes larger and subfoliose), abaxial surface and margin pubescent with erect to flexuose glandular (and a few eglandular) trichomes 0.1–0.3 mm long. Bracteoles linear-elliptic to oblanceolate to spatulate, 5–10 mm long, 1.6–2.6 mm wide, abaxially and marginally pubescent like bracts. Flowers sessile. Calyx 6.8–8 (–9 in fruit) mm long, lobes lance-linear, 6–6.5 (–8) mm long, 0.9–1.3 (–1.5) mm wide, abaxially sparsely pubescent like bracts, margin sparesly ciliate (primarily toward apex) with antrorse to flexuouse eglandular trichomes to 0.2 mm long. Corolla red, 35–42 mm long, externally pubescent with erect to flexuose eglandular trichomes 0.1–0.5 mm long, tube 20–24 mm long, ± gradually expanded distally, 2–3.7 mm in diameter near midpoint, upper lip rugulate, 13–20 mm long, 2-fid at apex, lower lip 13–19 mm long, lobes 2–3 mm long, 1.8–3 mm wide. Stamens inserted near apex of corolla tube, 19–22 mm long, filaments glabrous distally, thecae 2–2.9 mm long, ± equal in length, subparallel, unequally inserted (overlapping by 1.2–1.5 mm), glabrous, each with an inconspicuous basal appendage to 0.2 mm long; pollen 6-porate, insulae discrete or contiguous (sharing common walls or not). Style 33–40 m long, glabrous, stigma equally 2-lobed, lobes 0.2–0.4 mm long. Capsule 13–14.5 mm long, sparsely pubescent with erect to flexuose eglandular trichomes 0.1–0.2 mm long, stipe 5–6.5 mm long, head ellipsoid to obovoid, 8–8.5 mm long. Seeds 4, discoid, 3 mm long, 3 mm wide, minutely papillate, lacking trichomes.

Phenology.— Flowering: March, August–December; fruiting: December–January.

Habitats.— Wet montane forests, cloud forests, wooded slopes, along streams; 2100–2425 m.

Quezaltenango: *Skutch 936* (type, see above). **San Marcos**: *Breedlove & Almeda 64860* (CAS, K, MO, US).

This species (Fig. 12) is endemic to Guatemala (Quezaltenango, San Marcos) and is known by the type from Quezaltenango and by five collections from San Marcos. The type was noted to be a principal ground cover around 8000 feet under heavy forest on Volcán Zunil (fide a letter from the collector of the type, A. Skutch, to D. Gibson that is attached to the holotype). Skutch approached Volcán Zunil from Santa María de Jesús. In San Marcos, the species occurs on montane slopes between San Marcos and San Rafael Pie de la Cuesta, where it was last collected in 2010 (*Daniel et al. 11323* at BIGU, CAS, K, MO, US). It appears to be uncommon but locally frequent in this region; more than 40 plants were observed in 2010 on the moist forested slopes above

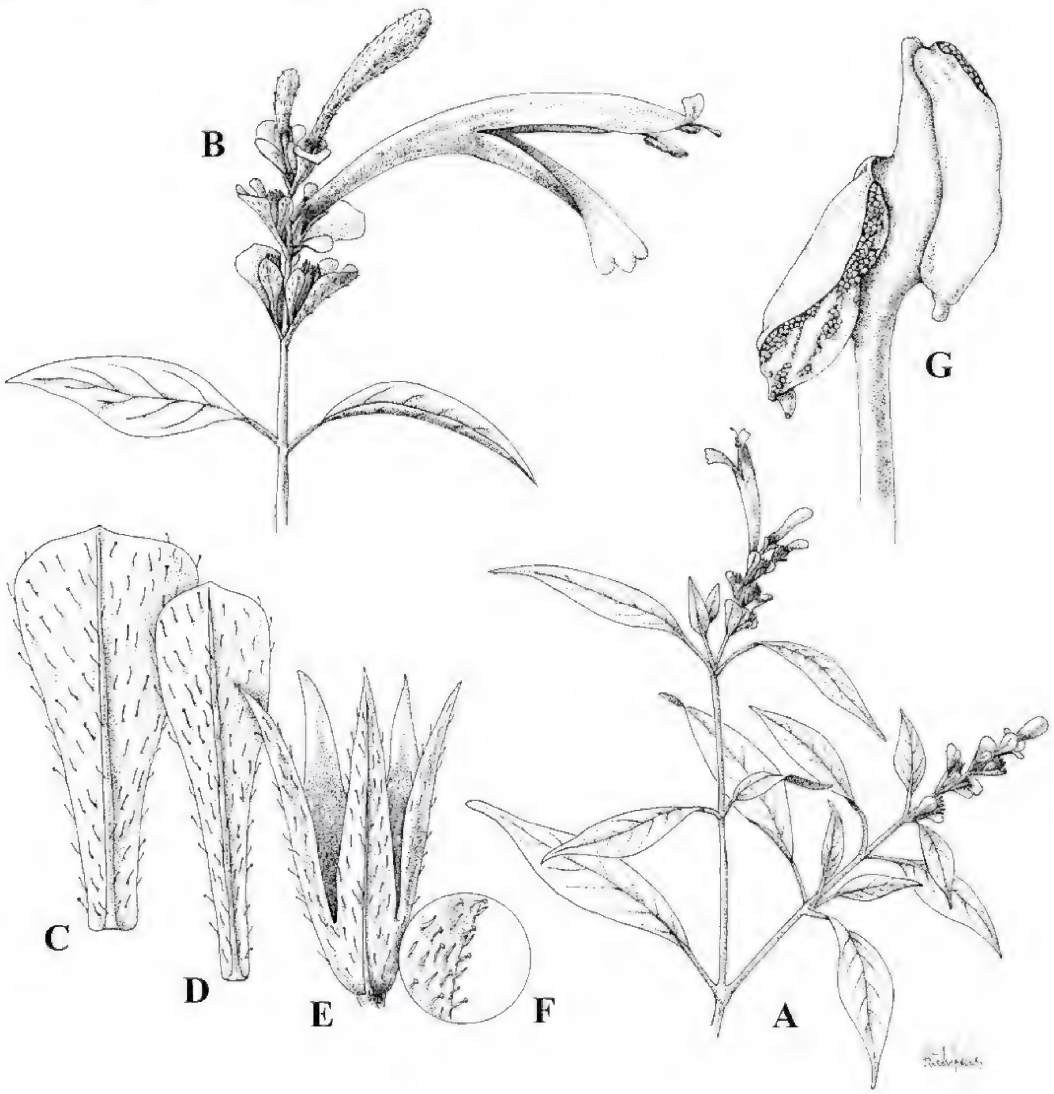


FIGURE 12. *Poikilacanthus skutchii* (*Breedlove & Almeda 64860*). A. Habit, × 0.5. B. Inflorescence with flower, × 1.3. C. Bract, × 7. D. Bracteole, × 7. E. Calyx, × 6. F. Trichomes on external surface of calyx, × 10. Anther, × 15. Drawn by A. Whitesides.

and along a 50 meter stretch of a stream crossing a highway. Although the species is still extant and locally frequent, its overall conservation status remains unknown.

***Pseuderanthemum alatum* (Nees) Radkl.**

RECENT DESCRIPTIONS.— Daniel (1995b), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: March, June–December; fruiting: October–March.

HABITATS.— Tall forests, moist secondary forests, ramonales; 150–350 m.

Petén: *Contreras 3744* (F, K, LL, MO, US).

Pseuderanthemum alatum is uncommonly collected in Guatemala, but is widespread in Mexico and other regions of Central America, where it is sometimes abundant. Gibson (1974) noted an apparent close relationship between this species and *P. cuspidatum*. Indeed, several collections (e.g., *Lundell 16059* from Petén) show some intermediacy in the diagnostic characters (e.g., calyx length and base of the leaf blade) used to distinguish them. In Guatemala, these two species appear to occur at different elevations.

***Pseuderanthemum cuspidatum* (Nees) Radkl.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: July–November; fruiting: February–March, September–November.

HABITATS.— Wet forests, moist broadleaf forests, dry forests, swamps, wet ravines, streamside slopes; 670–1800 m.

Alta Verapaz: *Standley 69972* (F). **Baja Verapaz**: *Croat 41356* (CAS, MO). **El Progreso**: *Ramirez 205* (BIGU). **Huehuetenango**: *Castillo & Castillo 2649* (F, MO, US).

Buceragenia glandulosa Leonard was recognized by Gibson (1974). Plants conforming to the type of this name were treated as cleistogamous-flowered individuals of *P. cuspidatum* by Daniel (1995b). Information on *Steyermark 51141* from Huehuetenango indicates that the leaves were silvery green abaxially with rose-colored nerves. Gibson (1974) noted the occurrence of the species in the department of Guatemala, but no specimens from there were located during this study.

***Pseuderanthemum praecox* (Benth.) Leonard**

RECENT DESCRIPTIONS.— Daniel (1995b, 1999a, 2004b), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: January–June; fruiting: March–April.

HABITATS.— Broadleaf forests, pine-oak forests, pine forests, moist slopes in shrubby pastures; 1500–1980 m.

Alta Verapaz: *von Türckheim 1199* (GH, US). **Baja Verapaz**: *Pittier 151* (US). **Chimaltenango**: *Standley 64391* (F). **Chiquimula**: *Dávila & Cóbar 1505* (BIGU). **El Progreso**: *Sharp 45266* (F, GH, NY). **Guatemala**: *Emeterio s.n.* 21 III 1993 (UVAL). **Quetzaltenango**: *Equipo CECON 1065* (BIGU, MO). **Quiché**: *Heyde & Lux 3116* (GH, K, NY, US). **San Marcos**: *Steyermark 37275* (F). **Santa Rosa**: *Heyde & Lux 4560* (GH, K, US). **Zacapa**: *Steyermark 43211* (F).

As interpreted here, this species is a heterogenous assemblage of plants that share the following characteristics: low herbs (less than 5 dm tall), homostylous flowers, conspicuous calyces (4–10 mm long), and glabrous capsules. It includes plants previously treated by Daniel (2001) as *P. fasciculatum* (Oerst.) Leonard in El Salvador. Daniel (2004b) discussed some of the morphological diversity and its seasonal basis among plants of this species from the northern portion of its distribution in Sonora, Mexico. Gibson (1974) noted the occurrence of the species in Huehuetenango, but no collections from that department were located during this study.

***Pseuderanthemum verapazense* Donn. Sm.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: March–April, December; fruiting: March, December.

HABITATS.— Tall forests, short forests, thickets, zapotales; 50–250 m.

Alta Verapaz: *von Tuerckheim 8258* (holotype: US; syntype of *P. adenocalyx* Lindau: presumably B, destroyed). **Izabal**: *Steyermark 39167* (F). **Petén**: *Lundell & Contreras 20668* (F, K, LL, MO, US).

Gibson (1974) noted the occurrence of *P. verapazense* in Chiquimula, likely based on Watson collections (e.g., *198a*, *271b*) from "eastern portions of Vera Paz and Chiquimula," which she annotated with this name.

***Razisea spicata* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854:142. 1855.** TYPE.— COSTA RICA. **Alajuela**: Bjerget Aguacate [Cerro de Aguacate], 2000 ft., Nov, *A. Oersted 10710* (holotype: C!).

Kolobochilus leiorhachis Lindau, Anales Inst. Fis.-Geogr. Nac. Costa Rica 9:188. 1898. TYPE.— COSTA RICA. Nine syntypes representing collections of Warscewicz, Pittier, Tonduz, and Biolley from diverse regions of Costa Rica were cited.

Perennial herbs or shrubs to 4 m tall. Young stems subquadrate to ridge-angled to ± flattened, ± evenly to ± bifariously pubescent with flexuose to retrorse to antrorsely appressed eglandular trichomes 0.1–0.4 mm long or nearly glabrous. Leaves petiolate, petioles to 70 mm long, blades elliptic, 115–430 mm long, 48–210 wide, 2.0–4.0 times longer than wide, acuminate at apex, attenuate at base, surfaces pubescent with mostly antrorsely appressed eglandular trichomes (concentrated along or restricted to veins), margin subcrenate to crenate, eciliate or ciliate. Inflorescence of terminal pedunculate racemes (or thyrses) to 460 mm long, rachis glabrous or evenly to ± bifariously pubescent with flexuose to retrorse to antrorse eglandular trichomes 0.1–1 mm long, dichasia opposite to subopposite, sessile (to pedunculate), 1–many-flowered, peduncles (if present) to 4 mm long. Bracts (triangular to) lance-subulate to lanceolate to ovate, 1–11 mm long, 0.7–2.2 mm wide, abaxial surface glabrous or pubescent along midvein with antrorse eglandular trichomes. Bracteoles (triangular to) lance-subulate to ovate, 0.7–7 mm long, 0.3–1.8 mm wide, abaxial surface glabrous or pubescent like bracts, secondary bracteoles similar to bracteoles except smaller. Flowers pedicellate, pedicels (1–) 6–20 mm long, glabrous or pubescent with erect to flexuose to antrorse eglandular trichomes 0.05–0.1 mm long. Calyx 4–13 mm long during anthesis (up to 15 mm long in fruit), abaxially glabrous, lobes lanceolate to linear-lanceolate, 3–14 mm long, subequal to unequal in length, 0.8–1.5 mm wide, margins eciliate or ciliate. Corolla red, ± truncate with a slight beak in bud, 44–64 mm long, externally glabrous proximally and pubescent distally (i.e., near lips and mouth) with antrorse to antrorsely appressed eglandular trichomes (sometimes very sparse or absent) 0.05–0.1 mm long or rarely pubescent over entire surface with erect to flexuose to antrorse eglandular trichomes 0.05–0.2 mm long, margins of lips ciliate with flexuose eglandular trichomes to 0.1 mm long, tube 35–55 mm long, narrow proximal portion 9–17 mm long, ± gradually expanded into throat, throat 27–43 mm long, 4.5–9 mm in diameter near midpoint, upper lip 6.5–14 mm long, lower lip ± truncate, 2.5–8 mm long, lobes 1–1.3 mm long, 0.7–1.2 mm wide. Stamens inserted near base of throat, 42–60 mm long, thecae red, 2.5–4.6 mm long. Style red, 58–78 mm long, stigma 0.2–0.4 mm long. Capsule 16–21 mm long, glabrous, stipe 9–12 mm long (usually longer than head), head 8–9 mm long. Seeds lenticular, 3–4 mm long, 2.6–3.4 mm wide, immature surfaces tuberculate-ridged, mature surfaces rugose to tuberculate-ridged (at least around margin, central portions often ± smooth).

PHENOLOGY.— Flowering: December; fruiting: unknown.

HABITAT.— "Uppermost ridges and summit of Cerro San Gil; "1200–1300" m.

Izabal: *Steyermark 41979* (F).

The sole known Guatemalan collection represents the northernmost occurrence for this species, which is frequently encountered in wet montane forests of southern Central America. Plants were collected on the uppermost ridges and summit of Cerro San Gil at 1200–1300 m elevation on 26–27 December 1941. The species has not been collected in Guatemala since that time. Gibson (1974) provided an illustration of *R. spicata*. Because of significant morphological variation in this widely distributed species (Guatemala to Colombia), a comprehensive description is provided above. Throughout its geographic range, considerable variation is evident in pubescence of the rachis, number of flowers per dichasium, pedicel length, pubescence of the corolla, bract/bracteole length, and calyx length. Guatemalan plants are perennial herbs to 1.2 m tall with: young stems glabrous; dichasia sessile, opposite, and 1-flowered; flower pedicels 2.5–3 mm long; bracts 4–6 mm long and bracteoles 3 mm long; calyces 8–11 mm long; corolla buds 30 mm long; and anther thecae 4–4.2 mm long.

***Ruellia blechum* L.**

RECENT DESCRIPTIONS.— Daniel (1995b, 1999a; as *Blechum pyramidatum*) and Daniel and Acosta (2003; as *B. pyramidatum*).

PHENOLOGY.— Flowering: throughout the year; fruiting: throughout the year.

HABITATS.— Lowland moist evergreen forests, moist to wet forests, short forests, tropical deciduous forests, acahuales, ramonales, moist to wet thickets, pastures, along streams, disturbed sites (e.g., clearings, pastures, roadsides); 0–1300 m.

LOCAL NAME.— "Corrimiento" (*Lundell 2170*).

Alta Verapaz: *Steyermark 44234* (F). **Baja Verapaz**: *Daniel & Véliz 11328* (BIGU, CAS). **El Progreso**: *Salazar 81* (BIGU, MO). **Escuintla**: *Standley 60146* (F). **Guatemala**: *Croat & Hannon 63568* (CAS). **Huehuetenango**: *DASA 4851* (USCG). **Izabal**: *Steyermark 42046* (F). **Petén**: *Lundell 16875* (F). **Quezaltenango**: *Steyermark 34500* (F). **Retalhuleu**: *Standley 66531* (F). **San Marcos**: *Daniel et al. 11320* (BIUG, CAS). **Santa Rosa**: *Standley 78037* (F). **Suchitepéquez**: *Standley 62212* (F, US). **Zacapa**: *Daniel et al. 11221* (BIGU, CAS).

The species has long been known as either *Blechum brownei* Juss (e.g., Gibson 1974) or *B. pyramidatum* (Lam.) Urb. (e.g., Daniel 1995b), which names are taxonomic synonyms. Molecular phylogenetic studies (Tripp et al. 2009) reveal *Blechum* to be monophyletic, but nested among *Ruellia*. Thus, recognition of the former genus renders the latter one paraphyletic.

***Ruellia donnell-smithii* Leonard**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: February–March; fruiting: February–March.

HABITATS.— Dry to wet thickets, weedy fields; 120–900 m.

Escuintla: *Donnell Smith 2015* (holotype: US; isotypes: GH, K, US). **Retalhuleu**: *Standley 88583* (F).

***Ruellia geminiflora* Kunth**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: December–June; fruiting: October–June.

HABITATS.— Oak forests, pine forests, dry and brushy slopes, disturbed sites (e.g., roadsides, clearings); 150–1100 m.

Alta Verapaz: *Steyermark 44043* (F, US). **Baja Verapaz**: *Kellerman 8041* (F). **Guatemala**: *Standley 80464* (F). **Izabal**: *Standley 72267* (F). **Petén**: *Lundell 3485* (F, MICH, US).

A fruiting collection from the department of Guatemala (near Finca La Aurora, 1500 m, 1938–1939 (frt), *Aguilar 334* at F, "maravilla de monte") was originally identified as this species and it appears superficially similar to it. It differs by having bracteoles and having very few glandular punctae on the calyx and capsules. Its capsules rupture on dehiscence much like those of *R. erythropus* (Nees) Lindau and species previously treated in *Blechum*. This type of dehiscence, with the base of the placenta and retinacula separating from the inner wall of the mature capsule and ± rising elastically, is sometimes present among specimens of *R. geminiflora*. The identify of *Aguilar 334* must await additional studies.

***Ruellia harveyana* Stapf**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: April–July, October; fruiting: April–July, October.

HABITATS.— Tall perennial forests, corozales, thickets, brushy slopes, disturbed sites (e.g., coffee plantations); 80–550 m.

LOCAL NAME.— "Violeta" (*Pittier 8582*).

Alta Verapaz: *Martínez S. et al. 22692* (CAS, MO, USCG). **Izabal**: *Lundell & Contreras 19319* (F, LL).

Gibson (1974) also recognized *R. obtusata* Blake, which was treated as conspecific with *R. harveyana* by Daniel (1995b). Leaf margins among Guatemalan plants vary from entire (*Pittier 8582* at US) to conspicuously sinuate-crenate (e.g., *Lewton 374* at US).

***Ruellia hookeriana* (Nees) Hemsl.**

RECENT DESCRIPTIONS.— Daniel (1995b), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: June–December; fruiting: September–November.

HABITATS.— Pine forests, pine-grass ridges, brushy slopes, disturbed sites (e.g., roadsides); 800–1500 m.

LOCAL NAME.— "Hierba de torro" (*Molina R. & Molina 26787*, *Steyermark 51093*).

LOCAL USES.— "Reputed to be used for when cattle cannot procreate; feed the cattle this plant and they are believed to be able to procreate afterward" (*Steyermark 51093*).

Baja Verapaz: *Tenorio L. et al. 14780* (CAS, USCG). **Chiquimula**: *Molina R. & Molina 26787* (F, MICH). **Guatemala**: *Croat 41901* (MO). **Huehuetenango**: *Steyermark 51476* (F, US). **Jalapa**: *Steyermark 33006* (F). **Jutiapa**: *Standley 75835* (F). **Petén**: *Contreras 2350* (LL). **Santa Rosa**: *Heyde & Lux 3112* (US, MO). **Zacapa**: *Steyermark 29512* (F).

***Ruellia inundata* Kunth**

RECENT DESCRIPTIONS.— Daniel (1995b, 1997b, 1999a).

PHENOLOGY.— Flowering: October–March; fruiting: November–March.

HABITATS.— Broad-leaved forests, tropical deciduous forests, thornscrub, moist to dry thickets, along streams, disturbed sites (e.g., roadsides); 120–1255 m.

Baja Verapaz: *Lewis s.n.* (F). **Chimaltenango**: *Johnston 1146* (F). **Chiquimula**: *Molina R. & Molina 25147* (F, US). **El Progreso**: *Molina R. & Molina 24937* (F, MO). **Guatemala**: *Standley 89420* (F). **Huehuetenango**: *Williams et al. 41378* (F). **Jutiapa**: *Standley 75979* (F, US). **Quiché**: *Standley 62499* (F). **Retalhuleu**: *Standley 87534* (F, US). **Santa Rosa**: *Standley 79205* (F). **Zacapa**: *Williams et al. 41864* (F).

Some Guatemalan plants have rose-pink corollas (*Molina R. & Molina 25147*) whereas others

have blue-purple corollas (e.g., *Croat & Hannon 63545* at MO, US). Gibson (1974) noted the occurrence of this species in Alta Verapaz. The only collection possibly from that department seen during this study is *von Tuerckheim II 1113 (8727)* at US. The original printed label indicates Cubilguitz in Alta Verapaz, but this locale has been crossed out and Amatitlán written in. Later printed labels say "Amatitlán, Depart. Amatitlán." This locale is in the department of Guatemala.

***Ruellia jussieuoides* Schlecht.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: January–March; fruiting: January–April.

HABITATS.— Wet montane forests, stream banks, lake margins; 100–580 m.

Alta Verapaz: *Daniel & Véliz 11339* (BIGU, CAS, K, MO). **Petén**: *Steyermark 45877* (F, US).

***Ruellia lactea* Cav.**

RECENT DESCRIPTIONS.— Daniel (1995b, 1999a), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: July; fruiting: unknown.

HABITAT.— Unknown; 2000 m.

Huehuetenango: *Steyermark 48216* (F). **Quiché**: *Heyde & Lux 3115* (US).

Gibson (1974) treated this species as *R. abbreviata* D.N. Gibson, which was considered to be conspecific with *R. lactea* by Daniel (1995b). Both collections cited above conform to the subcaulescent form of this species that has also been treated as *R. lactea* var. *acaulis* (Nees) Hemsl. Guatemalan plants often lack most or all of the glandular trichomes on the calyx and corolla prevalent among some Mexican plants. In Chiapas, Mexico, both caulescent and subcaulescent forms of the species occur in pine-oak forests.

***Ruellia latibracteata* D.N. Gibson**

RECENT DESCRIPTION.— Daniel (1995b; as *Blechum grandiflorum*).

PHENOLOGY.— Flowering: February–April; fruiting: February–April.

HABITATS.— Riparian forests, moist thickets, disturbed sites (e.g., roadsides); 600–1700 m.

Alta Verapaz: *Standley 91805* (F, US). **Baja Verapaz**: *von Tuerckheim II 1753* (US). **Chiquimula**: *Véliz et al. 15115* (BIGU).

This species has usually been treated as *Blechum grandiflorum* Oerst. Because *Blechum* is now treated in *Ruellia* (see above under *Ruellia blechum*), Gibson's name becomes the first available one in the latter genus.

***Ruellia matagalpae* Lindau**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: July–March; fruiting: February–March, July–August.

HABITATS.— Wet forests, tall forests, along streams; 230–665 m.

Alta Verapaz: *Wilson 270* (F). **Izabal**: *Pozuelos s.n.* 3 XII 1976 =*PEA 5910* (USCG). **Petén**: *Contreras 10438* (F, LL, US).

***Ruellia maya* T.F. Daniel**

RECENT DESCRIPTIONS.— Daniel (1995a, 1995b).

PHENOLOGY.— Flowering: September–March; fruiting: January.

HABITATS.— Wet montane forests, riparian forests, along streams; 300–1400 m.

LOCAL NAME.— "r-uɋ'u'ux kamenaq" (Quecchí; *Wilson 40877*).

LOCAL USE.— Graveyard ornamental (*Wilson 40877*).

Alta Verapaz: *von Tuerckheim II-832* (F, MO, US).

Ruellia maya is endemic to Chiapas and Guatemala. Gibson (1974) treated these plants as *Ruellia longituba* D.N. Gibson. Daniel (1995a) noted that the species represented by syntypes of this name are apparently not known from Guatemala. *Wilson 40877* (F), also from Alta Verapaz, notes the Quecchí name cited above in reference to "dead person's flower," and notes its use as a graveyard ornamental; this plant apparently grew "feral" in a former graveyard (now forest) near San Juan Chamelco. The species was collected in 2010 (*Daniel & Véliz 11340* at BIGU, CAS, K, MO) along the Río Sachichá in Alta Verapaz where fewer than 10 plants were noted.

***Ruellia megasphaera* Lindau**

Recent Description.— Daniel (1995b).

Phenology.— Flowering: December–March; fruiting: January–March.

Habitats.— Dry forests, wooded ravines, moist to dry thickets; 300–780 m.

Chimaltenango: *Johnston 525* (F). **Chiquimula**: *Tejada 212* (USCG). **Escuintla**: *Standley 89551* (F). **Guatemala**: *Aguilar 452* (F). **Retalhuleu**: *Standley 88170* (F). **Santa Rosa**: *Steyermark 33172* (F).

Plants referable to this species were treated by Gibson (1974) as *R. parva* (Nees) Hemsl., which name applies to another species (Daniel 1990c).

***Ruellia metallica* Leonard in P.C. Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 18:1253. 1938. Type**.— COSTA RICA. **Limón**: Zent banana farm, sea level, 2 May 1903, O. *Cook & C. Doyle 456* (holotype: US!).

Terrestrial to subepiphytic perennial herbs to 5 dm tall. Young stems quadrate to quadrate-sulcate to ± flattened, pubescent with retrorse eglandular trichomes 0.3–0.6 mm long, trichomes usually ± restricted to 4 or more longitudinal lines. Leaves petiolate, petioles to 40 mm long, blades ovate-elliptic to elliptic to lanceolate, 40–157 mm long, 8.5–74 mm wide, 2.1–8.1 times longer than wide, usually becoming smaller and narrower distally and intergrading with bracts, acute to acuminate at apex, acute to subattenuate at base, margin (entire to) crenate-sinuate, adaxial surface glabrous or nearly so, abaxial surface pubescent along major veins with antrorse eglandular trichomes. Inflorescence of dichasia borne in axils of distal leaves and/or bracts, usually forming a terminal spicate axis, rachis (if present) pubescent like young stems; dichasia opposite, 1–3 (or more?) per axil, sessile to subsessile (i.e., peduncles to 0.5 mm long), 1–3 (or more?)-flowered. Bracts intergrading with leaves proximally, lanceolate to linear, 5–22 (–31) mm long, 0.8–3 mm wide, abaxial surface pubescent with antrorse eglandular trichomes 0.2–0.3 mm long (usually ± restricted to midvein), margin ciliate with flexuose to antrorse eglandular trichomes. Bracteoles triangular to subulate to oblanceolate to subspatulate, 2–7.5 (–14) mm long, 0.7–1 mm wide, abaxial surface pubescent like bracts, secondary bracteoles (if present) similar to bracteoles except smaller. Flowers sessile to subsessile (i.e., pedicels to 1 mm long). Calyx 4.3–7.2 (–8.5 in fruit) mm long, lobes lance-subulate, 3–5.8 (–7) mm long, 0.6–0.7 mm wide, abaxially inconspicuously glandular punctate and sparsely pubescent with antrorse eglandular trichomes 0.05–0.1 mm long, the eglandular trichomes sometimes nearly absent. Corolla white to lavender (sometimes with the major veins of lobes pinkish), 21–33 mm long, externally pubescent with erect to flexuose to retrorse eglandular and glandular trichomes 0.05–0.2 mm long, tube 15–25 mm long, narrow proximal portion 8–14 mm long, ± abruptly expanded into throat, throat 7–14 mm long, longer or shorter or nearly equal to narrow proximal portion, 3.5–6 mm in diameter near midpoint, limb 9–17 mm in diameter, lobes 4–7.5 mm long, 3.5–6.5 mm wide. Stamens included, didynamous, shorter pair

3.5–4.5 mm long, longer pair 6–8 mm long, thecae 1.4–1.7 mm long, dorsally glabrous or glandular pubescent. Style included, 13–20 mm long, pubescent (sometimes inconspicuously so) with eglandular and glandular (sometimes inconspicuous or absent) trichomes, stigma usually 1-lobed, lobe 0.8–1.2 mm long. Capsule clavate, 10–12 mm long, puberulent with antrorse eglandular and sessile glandular trichomes less than 0.05 mm long, stipe 5–6 mm long, head ellipsoid to obovoid, 5–6 mm long. Seeds up to 8 (usually fewer by abortion) per capsule, lenticular, 2.2–3.3 mm long, 1.9–3 mm wide, surfaces ± smooth (microscopically striate), margin covered with hygroscopic trichomes (appearing papillose-fringed in dry state).

PHENOLOGY.— Flowering: April; fruiting: April, November.

HABITAT.— Wet forests; 30–600 m.

Izabal: *Steyermark 38716* (F). **Santa Rosa**: *Standley 78364* (F).

***Ruellia nudiflora* (Engelm. & A. Gray) Urb.**

RECENT DESCRIPTIONS.— Daniel (1995b, 1997b, 1999a), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: (January–) March–November; fruiting: (January–) March–November.

HABITATS.— Forests (acaguales, corozoles, ramonales), distrubed sites (e.g., roadsides, clearings, pastures); 100–250 m.

LOCAL NAMES.— "Campanilla" (*Kufer 8*), "violeta silvestre" (*Zabala s.n.* 6 IX 1984).

Chiquimula: *Kufer 8* (UVAL). **Petén**: *Egler 42-312* (F). **Zacapa**: *Deam 6317* (F, MICH, MO, US).

Cleistogamous flowers, which begin to appear in January, are borne on the basal or near basal axillary panicles. Chasmogomous flowers are produced in terminal panicles that usually appear somewhat later (April). Sometimes cleistogamous flowers are also borne in the terminal panicles (e.g., early in the flowering season).

Gibson (1974) included Guatemala and Santa Rosa among the departments in which *Ruellia nudiflora* occurs. Some collections from the former department pertain to *R. puberula* (see below), which Gibson (1974) treated as conspecific with *R. nudiflora*. She annotated *Standley 79450* from Santa Rosa (along the Avellana road, S of Guazacapán, 150 m, 6 Dec 1940-flr, frt, at F) with the name *R. nudiflora* but plants on this collection appear more like *R. puberula* (i.e., they lack a terminal glandular thyrse, the corollas are not conspicuously glandular pubescent, and the capsules lack glandular trichomes).

***Ruellia paniculata* L.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: October–March; fruiting: October–May.

HABITATS.— Short forests, dry forests, swamp margins, dry to moist thickets, disturbed sites (e.g., clearings); 0–700 m.

Chiquimula: *Pittier 1898* (US). **Escuintla**: *Pearsall 10222* (UVAL). **Jutiapa**: *Steyermark 31800* (F). **Petén**: *Tún Ortíz 893* (F, MO). **Retalhuleu**: *Standley 87675* (F, US). **San Marcos**: *Steyermark 37853* (F, US). **Zacapa**: *Steyermark 29234* (F).

Guatemalan specimens that note flower color reveal that plants with purple/blue (lavender) corollas are either the most prevalent (or the only) floral color form in the country.

***Ruellia pereducta* Standl.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: February–June; fruiting: February–June.

HABITATS.— Rain forests, montane forests, tall forests, ramonales, zapotales; 90–340 m.

Alta Verapaz: *Steyermark 45181* (F, US). **Izabal**: *Johnson 1232* (US). **Petén**: *Lundell 16774* (CAS, F, LL).

This species is sometimes identified as *R. stemonacanthoides*. These two species have simlar inflorescences, capsules, and seeds and are likely closely related. Guatemalan plants of each can be distinguished by the following couplet:

1. Peduncles quadrate-alate; stamens 17–22 mm long, thecae 2.2–3.2 mm long, usually at least partially exserted from mouth of corolla; flowers pedicellate, pedicels 1.2–6 mm long; corolla pinkish or reddish (sometimes reported as bluish or purplish), narrow proximal portion of tube 9–14 mm long, throat ± cylindric, 14–26 mm long (longer than narrow proximal portion); plants of the Caribbean versant. . . . . *R. pereducta*
1. Peduncles terete to subquadrate; stamens 6–10 mm long, thecae 1.8–2 mm long, included in corolla tube; flowers sessile or subsessile (i.e., pedicels to 2 mm long); corolla blue-purple; narrow proximal portion of tube 17–21 mm long, throat obdeltate, 12–13 mm long (shorter than narrow proximal portion); plants of the Pacific versant . . . . . *R. stemonacanthoides*

Although corollas of *R. stemonacanthoides* are blue-purple (often lavender), those of *R. pereducta* from Guatemala are described as either reddish, pinkish, or bluish (e.g., reddish, reddish-lilac, deep pink, red-purple, lilac, carmine, lilac-carmine, pink, blue, and light purple). Whether more than variation on a single color is present in the latter species remains to be determined.

***Ruellia puberula* (Leonard) Tharp & F.A. Barkley**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: April–June; fruiting: June.

HABITATS.— Disturbed sites (e.g., pastures, clearings); 110–1120 m.

Chiquimula: *Steyermark 30344* (F). **Guatemala**: *Pittier 135* (US). **Jutiapa**: *Morales et al. 2486* (USCG). **Petén**: *Zomer 267* (F). **Zacapa:** *Deam 6318* (holotype of *R. nudiflora* var. *puberula* Leonard: US; isotypes: F, MICH).

Gibson (1974) included this taxon within *R. nudiflora*; Daniel (1995b) treated them as separate species. Among Guatemalan collections, corollas vary from 25 to 47 mm in length with the narrow proximal portion of the tube 6 to 13 mm long and the throat 12 to 20 mm long; capsules are pubescent throughout (although somewhat sparser proximally) with erect to flexuose to retrorse eglandular trichomes 0.1 to 0.2 mm long, and often with a few scattered erect glandular trichomes at and/or near the apex. Like plants from El Salvador (Daniel 2001), some Guatemalan plants have eglandular calyces (e.g., *Pittier 135*) and others have glandular calyces (e.g., *Deam 6332*).

***Ruellia pygmaea* Donn. Sm., Bot. Gaz. (Crawfordsville) 48:298. 1909.** TYPE.— GUATEMALA. **Alta Verapaz**: near Cubilquitz, 600 m, May 1904, *H. von Tuerckheim 8725* (holotype: US!).

Decumbent to erect herbs to 2 dm tall. Young stems quadrate-sulcate, ± evenly pubescent with retrorse to retrorsely appressed eglandular trichomes 0.3–0.7 mm long, sometimes with an overstory of erect to flexuose eglandular trichomes to 1.8 mm long as well. Leaves petiolate, petioles to 10 mm long, blades ovate to ovate-elliptic, 14–53 mm long, 8–27 mm wide, 1.6–2.5 times longer than wide, acute to subattenuate at apex, acute at base, margin entire, ciliate, abaxial surface pubescent with antrorse to antrorsely appressed eglandular trichomes along major veins and flexuose to antrorse eglandular trichomes in intercostal regions. Inflorescence of densely bracteate terminal dichasiate spikes to 4.5 cm long, distal pair of leaves sometimes also bearing dichasia; dichasia

opposite, sessile, 1-flowered. Bracts subfoliose, petiolate, ovate-elliptic to elliptic, 11–30 mm long, 4.7–13.5 mm wide, abaxial surface pubescent with understory of antrorse to antrorsely appressed eglandular trichomes to 0.5 mm long along major veins and with an evenly disposed overstory of flexuose eglandular trichomes to 1.8 mm long, margin ciliate with overstory type trichomes and sometimes with an understory of scattered and inconspicuous erect glandular trichomes to 0.1 mm long as well. Bracteoles oblanceolate to obovate, 3.5–6.5 mm long, 0.6–1 mm wide, abaxial surface pubescent like bracts (sometimes very sparsely so). Flowers sessile to subsessile (i.e., pedicels to 0.5 mm long). Calyx 3.5–4 mm long, tube 1 mm long, lobes subulate, 2.5–3 mm long, abaxially pubescent (sometimes very sparsely so) with flexuose eglandular trichomes 0.2–0.3 mm long. Corolla blue-purple, 17–26 mm long, externally pubescent with erect to flexuose eglandular and glandular (sometimes sparse and inconspicuous) trichomes 0.05–0.2 mm long, tube 17–19 mm long, narrow proximal portion 6–9 mm long, ± abruptly expanded into throat, throat 6.5–11 mm long, 4–5 mm in diameter near midpoint, lobes 4–7.5 mm long, 4–6.5 mm wide. Stamens didynamous, included in throat, 5–7 mm long, filaments of distal pair glandular, thecae 1.7–2 mm long. Style 13 mm long, pubescent with eglandular trichomes, stigma 1-lobed, 1.2–1.3 mm long. Capsule capitate, 7.5–9.5 mm long, pubescent with erect to flexuose eglandular trichomes 0.1–0.2 mm long, stipe 3–3.5 mm long, head ellipsoid to obovoid, 4.5–6 mm long. Seeds 4, lenticular, 2.3–2.4 mm long, 2–2.3 mm wide, margin (only) covered with hygroscopic trichomes.

PHENOLOGY.— Flowering: January (cleistogamous flowers)–March–June (chasmogamous flowers); fruiting: January–June.

HABITATS.— Lower montane rain forests, wet forests, tall forests, wooded slopes, wet thickets; near sea level–600 m.

LOCAL NAME.— "Rash-ru-quén" (*Steyermark 44671*).

LOCAL USE.— "Fresh leaves applied to eye lids with eyes closed said to relieve reddening of eyes" (*Steyermark 44671*).

Alta Verapaz: *Steyermark 44671* (F, US). **Izabal**: *Daniel et al. 11244* (BIGU, CAS, MO). **Petén**: *Pöll s.n.* 22 VII 1993 (UVAL).

This species is endemic to Guatemala and Belize. Gibson's (1974) description of the calyx and corolla appears to be missing a portion of text. Pollen of this species, which is typical of the genus (i.e., 3-porate with interapertural surfaces coarsely reticulate), is illustrated here for the first time (Fig. 8).

***Ruellia spissa* Leonard**

RECENT DESCRIPTIONS.— Daniel (1995b), Daniel and Acosta (2003).

PHENOLOGY.— Flowering: May–August; fruiting: July–August.

HABITAT.— Unknown; 1400–1515 m.

LOCAL NAME.— "Maravilla celeste" (*Tonduz 620*).

Guatemala: *Tonduz 620* (holotype of *R. pratensis* D.N. Gibson: F; isotypes: AGUAT, US). **Huehuetenango**: *Seler & Seler 2984* (US).

Gibson (1972, 1974) treated this species as *R. pratensis*, a taxonomic synonym (see Daniel 1995b), and provided an illustration of it. In Chiapas plants occur in pine-oak forests.

***Ruellia standleyi* Leonard, J. Wash. Acad. Sci. 31:98. 1941.** TYPE.— GUATEMALA. **Quezaltenango**: Finca Pireneos, below Santa María de Jesús, 1350–1380 m, 11 Mar 1939, *P. Standley 68390* (holotype: F).

Herbs to 1.2 m tall. Young stems quadrate to quadrate-sulcate to ± flattened, pubescent with

erect to flexuose glandular and eglandular trichomes 0.2–1 (–1.5) mm long (viscid), trichomes evenly disposed or ± concentrated in 2 lines. Leaves petiolate, petioles to 90 mm long, blades ovate to elliptic, 43–176 mm long, 23–96 mm wide, 1.7–2.2 times longer than wide, acute-apiculate at apex, acute to subattenuate at base, margin crenate-dentate, surfaces viscid. Inflorescence of terminal (sometimes with new axillary growth overtopping inflorescence which then appears axillary) dichasiate racemes (to thyrses) to 21 cm long, peduncle and rachis viscid (trichomes sometimes mostly glandular); dichasia opposite, borne in axils of reduced distal leaves and bracts, sessile to subsessile (peduncles to 1 mm long) or with proximalmost pair sometimes borne on peduncles to 20 mm long, (1–) 3–many-flowered, expanded via viscid secondary peduncles to 17 mm long. Bracts obovate to oblanceolate to elliptic, 3–19 mm long, 1.5–3 mm wide, abaxial surface viscid, proximalmost bracts often subfoliose and up to 70 × 11 mm. Bracteoles linear to elliptic to oblanceolate, 2.5–4.5 (–7) mm long, 0.5–1.2 mm wide, abaxial surface viscid; secondary bracteoles similar to bracteoles. Flowers sessile to subsessile (pedicels to 1 mm long). Calyx 6–11 mm long (–17 mm long in fruit), tube 1–1.5 (–2) mm long, lobes subulate, 5–9.5 mm long (–16 mm long in fruit), abaxially viscid. Corolla greenish white to yellowish, 11–19 mm long, externally pubescent with flexuose eglandular (and sometimes glandular as well) trichomes 0.3–0.8 mm long, tube 8–10 mm long, narrow proximal portion 2–3 mm long, abruptly expanded into throat, throat 6.5–9 mm long, 3.5–5.5 mm in diameter near midpoint, lobes 2.5–5 mm long, 2–4.3 mm wide. Stamens didynamous, shorter pair 3.5–5 mm long, longer pair 5–7 mm long, thecae 1.8–2.2 mm long. Style 7–8 mm long, pubescent (at least proximally) with eglandular trichomes, stigma 1-lobed, 0.6–1 mm long. Capsule narrowly ellipsoid (linear), 11–16 mm long, ± sparsely pubescent distally with erect to flexuose glandular and eglandular trichomes 0.1–0.3 mm long. Seeds 12 per capsule, 2.2–2.5 mm long, 2–2.4 mm wide, surfaces and margin covered with appressed hygroscopic trichomes.

PHENOLOGY.— Flowering: February–April, July; fruiting: February–April, July, December.

HABITATS.— Moist forests, tall forests, moist to wet thickets; 300–1350 m.

Petén: *Contreras 10435* (F, LL, US). **Quezaltenango**: *Standley 87974* (F). **San Marcos**: *Steyermark 52314* (F). **Suchitepéquez**: *Standley 66970* (F).

This species is unusual among Mesoamerican *Ruellia* because of its relatively small, funnelform, and greenish white or yellowish corollas. It is unique among North American and Central American *Ruellia* by the combination of its greenish white to yellowish corollas, crenate-dentate leaf margins, viscid pubescence, and narrowly ellipsoid capsules. The well developed inflorescence is a result of elongate secondary peduncles among the dichasia. Its pollen, which is typical for *Ruellia*, was illustrated in Daniel (1993b).

***Ruellia stemonacanthoides* (Oerst.) Hemsl.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: January–March; fruiting: January–March.

HABITATS.— Dense forests, wooded ravines, moist thickets, along streams; 80–800 m.

LOCAL NAME.— "Lilu" (*Morales R. 1051*).

Escuintla: *Donnell Smith 2115* (lectotype of *R. guatemalensis* Donn. Sm.: US; isolectotype: K). **Retalhuleu**: *Donnell Smith 2692* (syntype of *R. guatemalensis*: US). **San Marcos**: *Steyermark 37563* (F). **Suchitepéquez**: *Morales R. 1051* (AGUAT, F).

In addition to the collections noted above, Gibson (1974) reported this species from the department of Guatemala (undoubtedly based on her annotation of *Aguilar 553* at F, from an unstated locale in that department, but which does not pertain to that species and which does not permit identification due to the lack of mature flowers or fruits), and MacVean (2006) reported it from Sololá. I have not seen any collections from those departments that pertain to *R. stenonacanthoides*.

Gibson (1974) noted that the "type" of *R. guatemalensis* was *Donnell Smith 2115*, and she annotated the specimen at US of this collection as the holotype. Because no holotype was designated in the protologue, this specimen is a syntype. If Gibson's published indication (combined with her annotation) of this collection as the type does not fulfill the requirements of the *International Code of Botanical Nomenclature* (McNeill et al. 2006) for lectotypification, then *Donnel Smith 2115* at US is designated here as lectotype of *R. guatemalensis*.

The distinctions between *R. stemonacanthoides* and the morphologically similar *R. pereducta* are noted under the latter species above.

***Ruellia tuberosa* L.**

RECENT DESCRIPTIONS.— Correll and Correll (1982); Fournet (2002).

PHENOLOGY.— Flowering: July; fruiting: July.

HABITAT.— Along streams; 300 m.

Izabal: *P. Herrara s.n.* 2-VII-2003 (BIGU, MO).

This collection from "Entre Ríos, La Jutera" was made on 2 July 2003 and apparently represents the first collection of the species in Guatemala. It greatly resembles collections of *R. tuberosa* from the Carribean lowlands of Honduras, where plants are apparently both cultivated and naturalized. The collection noted above would appear to represent a naturalized occurrence. A white-flowered form of this mostly blue-flowered species is also cultivated in Guatemala (e.g., *Véliz 20689* at BIGU). *Ruellia tuberosa* is purportedly native to the West Indies and northern South America (Leonard 1951).

***Sanchezia parvibracteata* Sprague & Hutch.**

RECENT DESCRIPTION.— Daniel (1995b).

PHENOLOGY.— Flowering: January–February; fruiting: unknown.

HABITAT.— Moist thickets; 235–600 m.

Quezaltenango: *Standley 87961* (F). **Retalhuleu**: *Kellerman 6642* (F). **Suchitepéquez**: *Steyermark 35368* (F).

Gibson (1974) indicated that this species was widely planted and sometimes naturalized in Guatemala. Standley's collection from Quezaltenango noted that plants were naturalized. Steyermark's collection from the southern lower slopes of Volcán Zunil, near Finca Las Nubes at 500–800 m, was not noted to be cultivated and might represent a naturalized occurrence. Kellerman's collection also does not indicate cultivation. Other collections from Guatemala were noted to have been cultivated. The species appears to be native to South America, and possibly southern Central America (Daniel 1995b).

***Schaueria parviflora* (Leonard) T.F. Daniel**

RECENT DESCRIPTION.— Daniel (1990b).

PHENOLOGY.— Flowering: March–May; fruiting: March–May.

HABITAT.— Wet forests; near sea level.

Izabal: *Standley 72949* (holotype of *Streblacanthus parviflorus* Leonard: F; isotype: US).

Gibson (1974) treated this species as *Streblacanthus parviflorus*, a nomenclatural synonym (see Daniel 1990b). *Schaueria parviflora* also occurs in southern Mexico, where it has been collected numerous times in the past 25 years.

***Spathacanthus hahnianus* Baill.**

RECENT DESCRIPTIONS.— Daniel (1995b, 1999b).

PHENOLOGY.— Flowering: August; fruiting: unknown.

HABITATS.— Wet forests, forest borders; ca. 1150 m.

Alta Verapaz: *von Tuerckheim 1030* (holotype of *Macfadyena simplicifolia* Donn. Sm.: US; isotypes: GH, K, M, US).

Spathacanthus hahnianus is rare or possibly extirpated in Guatemala, known from a single locality in Honduras, and widespread and well collected in eastern and southern Mexico. Gibson (1974) treated this species as *Spathacanthus simplicifolius* (Donn. Sm.) Leonard, a taxonomic synonym (see Daniel 1995b, 1999b).

***Spathacanthus parviflorus* Leonard**

RECENT DESCRIPTIONS.— Daniel (1995b, 1999b).

PHENOLOGY.— Flowering: January, May–August; fruiting: January–February, June–September.

HABITATS.— Rain forests, moist forests, montane forests, moist mixed forests, cloud forests, slopes, along streams; 970–2000 m.

LOCAL NAMES.— "La flor copal de montaña" (*Steyermark 33607*); "violeta de montaña" (*White 5419*).

Chimaltenango: *Steyermark 52100* (F, US). **Guatemala**: *Hatch & Wilson s.n.* 17 Aug 1936 (F). **Quezaltenango:** *Skutch 961* (holotype: US; isotypes: A, BM, L, NY, US). **San Marcos**: *Croat 40846* (CAS, MO). **Sololá**: *Hatch & Wilson 342* (F). **Suchitepéquez**: *Steyermark 46632* (CAS, F, NY, US).

***Stenandrium dulce* (Cav.) Nees**

RECENT DESCRIPTIONS.— Daniel (1985, 1999a), Daniel and Acosta (2003).

PHENOLOGY.— Flowering: March, June–July; fruiting: July.

HABITAT.— Unknown; ca. 200 m.

Alta Verapaz: *von Tuerckheim 3588* (holotype of *S. guatemalense* Leonard: US; isotypes: GH, K). **Petén**: *Lundell 3707* (F, MICH).

Although poorly collected in Guatemala, this species is widespread (USA to Chile) and elsewhere often abundant in diverse communities including arid associations, dry forests, grasslands, and pine forests.

***Stenandrium pedunculatum* (Donn. Sm.) Leonard**

RECENT DESCRIPTIONS.— Daniel (1985, 1995b).

PHENOLOGY.— Flowering: June, October; fruiting: June, November.

HABITATS.— Moist thickets, wet ravines, moist and brushy slopes; 185–1400 m.

Huehuetenango: *Steyermark 51400* (F). **Jalapa**: *Standley 77063* (F). **Jutiapa**: *Standley 75318* (F). **Zacapa:** *Deam 6277* (holotype of *Blechum pedunculatum*: US; isotypes: GH, LL, MICH, MO).

***Stenandrium subcordatum* Standl.**

RECENT DESCRIPTION.— Daniel (1985).

PHENOLOGY.— Flowering: March; fruiting: March, July.

HABITATS.— Zapotales, savannas, dry arroyos; 180–250 m.

Petén: *Bartlett 12283* (CAS, K, MICH, TEX, US).

This species is not well collected in Guatemala, but was collected as recently as 1992 in Petén (*Pöll & Escobar s.n.* 5 VII 1992 at UVAL).

***Stenostephanus azureus* (D.N. Gibson) T.F. Daniel, comb. nov.**

Habracanthus azureus D.N. Gibson, Fieldiana, Bot. 34:59. 1972. TYPE.— GUATEMALA. **San Marcos**: W-facing slope of Sierra Madre, near Aldea Fraternidad, between San Rafael Pie de la Cuesta and Palo Gordo, 1800–2400 m, wet mountain forest, 10–18 Dec 1963, *L. Williams et al. 25808* (holotype: F!).

Perennial herbs to 2 m tall. Young stems subquadrate to quadrate-sulcate, pubescent with flexuose to antrorse to retrorse eglandular trichomes 0.2–0.8 (–1.2) mm long, trichomes with ± conspicuous maroon septae, ± evenly disposed or concentrated in 2 lines. Leaves petiolate, petioles to 60 mm long, blades elliptic, 27–230 mm long, 14–86 mm wide, 1.7–3.5 times longer than wide, acute to acuminate at apex, (rounded to) acute to attenuate at base, surfaces pubescent (especially along major veins) with flexuose to antrorse eglandular trichomes, margin entire, ciliate. Inflorescence of (axillary and) terminal pedunculate thyrses to 280 mm long, peduncle and rachis often dark maroon-black, quadrate to ridge-angled to somewhat flattened, glabrous (or proximally pubescent with sparse trichomes like those of young stems or rarely pubescent with flexuose glandular trichomes to 0.7 mm long); dichasia opposite, (1–) 3–many-flowered, pedunculate, peduncles 7–29 mm long, glabrous (or rarely pubescent with glandular trichomes like those of rachis). Bracts (linear to) subulate to triangular-subulate, 1–3 mm long, 0.4–0.8 mm wide, (rounded to) acute at apex, abaxial surface glabrous (or rarely pubescent with glandular trichomes like those of rachis). Bracteoles subulate to triangular-subulate, 1–2.5 mm long, 0.5–0.7 mm wide, abaxial surface glabrous (or rarely pubescent with glandular trichomes like those of rachis). Flowers subsessile to short-pedicellate, pedicels 0.2–1.5 mm long, glabrous (or rarely pubescent with glandular trichomes like those of rachis), lateral flowers borne on secondary peduncles (3–) 8–16 mm long. Calyx dark maroon-black, 5–11 mm long (up to 20 mm long in fruit), abaxial surface glabrous or with sessile to stipitate glandular trichomes to 1 mm long (these sometimes restricted to distal half of lobes), lobes linear to lance-linear, 5–12 (–19) mm long, subequal to unequal in length, 0.4–1 mm wide. Corolla linear-elliptic in bud, blue-purple, 18–25 mm long, externally glabrous, tube 13–18 mm long, abruptly expanded into throat, narrow proximal portion 3–6 mm long, throat ± saccate, 10–13 mm long, 4.5–7 mm in diameter near midpoint, upper lip straightforward to curved upward, 5–7 mm long, lower lip straightforward, 5–6.3 mm long, 3-lobed, lobes 1.5–2 mm long, 1.2–2 mm wide. Stamens inserted near base of throat, 18–27 mm long, filaments blue-purple, thecae blue-purple, 2.8–3.8 mm long; pollen globose-elliptic, 2 circular regions echinate to tuberculate, peripheral band continuous, rugose and with a central band of echinae. Style 24–32 mm long, stigma 0.1 mm long. Capsule 11–15 mm long, glabrous. Seeds lenticular, 2.5–3 mm long, 1.9–2.5 mm wide, prominently tuberculate with conical tubercles when immature, becoming ± tuberculate to rugose-ridged (or with the ornamentation sometimes becoming ± restricted toward the periphery of the seed) to ± smooth when mature.

PHENOLOGY.— Flowering: December–April; fruiting: December–April.

HABITATS.— Wet montane forests, cloud forests, slopes; 1600–2775 m.

Alta Verapaz: *Standley 91480* (F). **San Marcos**: *Williams et al. 26267* (F, GH, NY, US).

Stenostephanus azureus is endemic to Guatemala (Alta Verapaz, San Marcos), and has been collected at least once in Alta Verapaz and at least eight times in San Marcos (as recently as 2010: *Daniel et al. 11300* at BIGU, CAS, MO). Along a trail on the wet montane slopes facing Volcán Tajumulco in the Bosque Municipal de San Marcos reserve, only two or three low herbs (to 5 dm tall) were seen in January 2010. Along this same trail an abundance of robust plants to 1.8 m tall was noted by M. Véliz in February 2006 (pers. comm.; *Véliz et al. 16741* at BIGU). These observations suggest that a plietesial life history is possible for this species (cf. Daniel 2006). Although extant and apparently thriving in at least one protected reserve, the conservation status of *S. azureus*

remains unknown. Gibson (1972; as *Habracanthus azureus*) provided an illustration of the species. The presence/absence of glands on the calyx often varies within an inflorescence (e.g. *Véliz et al. 16741* has some inflorescences with no glands and others that have conspicuous glands). *Stenostephanus azureus* can be distinguished from the morphologically similar *S. latilabris* by the characters in the following couplet:

Bracts subulate to triangular subulate, (rounded to) acute at apex, 0.4–0.7 mm wide; flowers ± pendulous; calyx 5–11 (–13.5) mm long, lobes 5–12 mm long; corolla 18–25 mm long, tube 13–16 mm long, abruptly expanded into throat, throat ± saccate, 10–12 mm long, 4.5–7 mm in diameter near midpoint; stamens inserted near base of throat; style 24–32 mm long ..... *S. azureus*

Bracts triangular to linear-elliptic, rounded to subacute at apex, 0.7–1.2 mm wide; flowers not pendulous; calyx 4–6 mm long, lobes 3.5–5 mm long; corolla 10–14.5 mm long, tube 4–6 mm long, lacking a well-defined or saccate throat, 0.9–1.4 mm in diameter near midpoint; stamens inserted in distal 1/2–1/3 of corolla tube; style 11–14 mm long ..... *S. latilabris*

***Stenostephanus latilabris* (D.N. Gibson) T.F. Daniel**

RECENT DESCRIPTIONS.— Daniel (1995b, 1999c).

PHENOLOGY.— Flowering: December–January, July; fruiting: unknown.

HABITATS.— Cloud forests, along streams, clearings; 1515–2200 m.

Baja Verapaz: *Williams et al. 43128* (F). **Quiché**: *A. Skutch 1836* (holotype of *Habracanthus latilabris* D.N. Gibson: US; isotype: A). **San Marcos**: *Daniel et al. 11325* (BIGU, CAS, K, MO, US).

Gibson (1974) treated this species as *Habracanthus latilabris*, a nomenclatural synonym (see Daniel 1995b). Gibson (1972) provided an illustration of the species. Capsules of *S. latilabris* remain unknown.

Stenostephanus latilabris is endemic to Guatemala and a bordering region of Chiapas. It is known from six collections, including recent ones from both countries. During studies in San Marcos in January 2010 a large population (more than 100 plants, many of which were not in flower) of the species was located along a stream in a ravine.

***Stenostephanus monolophus* (Donn. Sm.) T.F. Daniel**

RECENT DESCRIPTIONS.— Daniel (1995b, 1999c).

PHENOLOGY.— Flowering: September–March; fruiting: October–April.

HABITATS.— Dense and wet mixed forests, moist evergreen forests, cloud forests, moist to wet thickets, deep ravines; 1500–2700 m.

LOCAL NAME.— "Coqueta" (*Morales R. 1237*).

Alta Verapaz: *Standley 90561* (F, US). **Chimaltenango:** *J. Morales R. 1237* (holotype of *Glockeria moralesii* Standl.: F; isotype: AGUAT). **Escuintla**: *Standley 61282* (F, US). **Quezaltenango**: *Breedlove & Almeda 64849* (CAS, BR, F, K, MICH, MO, US). **Sacatepéquez:** *Heyde & Lux 4556* (holotype of *Glockeria monolopha* Donn. Sm.: US; isotypes: GH, K, US). **San Marcos**: *Standley 66171* (F). **Sololá**: *Molina R. & Molina 26674* (F, US).

Gibson (1974) treated this species (Fig. 13) as *Hansteinia monolopha* (Donn. Sm.) D.N. Gibson, a nomenclatural synonym (see Daniel 1995b, 1999c). Daniel (1999c) noted considerable variation in pubescence among Chiapan collections of this species. Guatemalan plants also exhibit variation in pubescence. For example, vesture of the inflorescence rachises and calyces varies from densely pubescent with stipitate glandular trichomes (e.g., *Daniel & Veliz 11209* from Sacatepéquez) to sparsely pubescent with stipitate glandular trichomes (e.g., *Heyde & Lux 4556*)

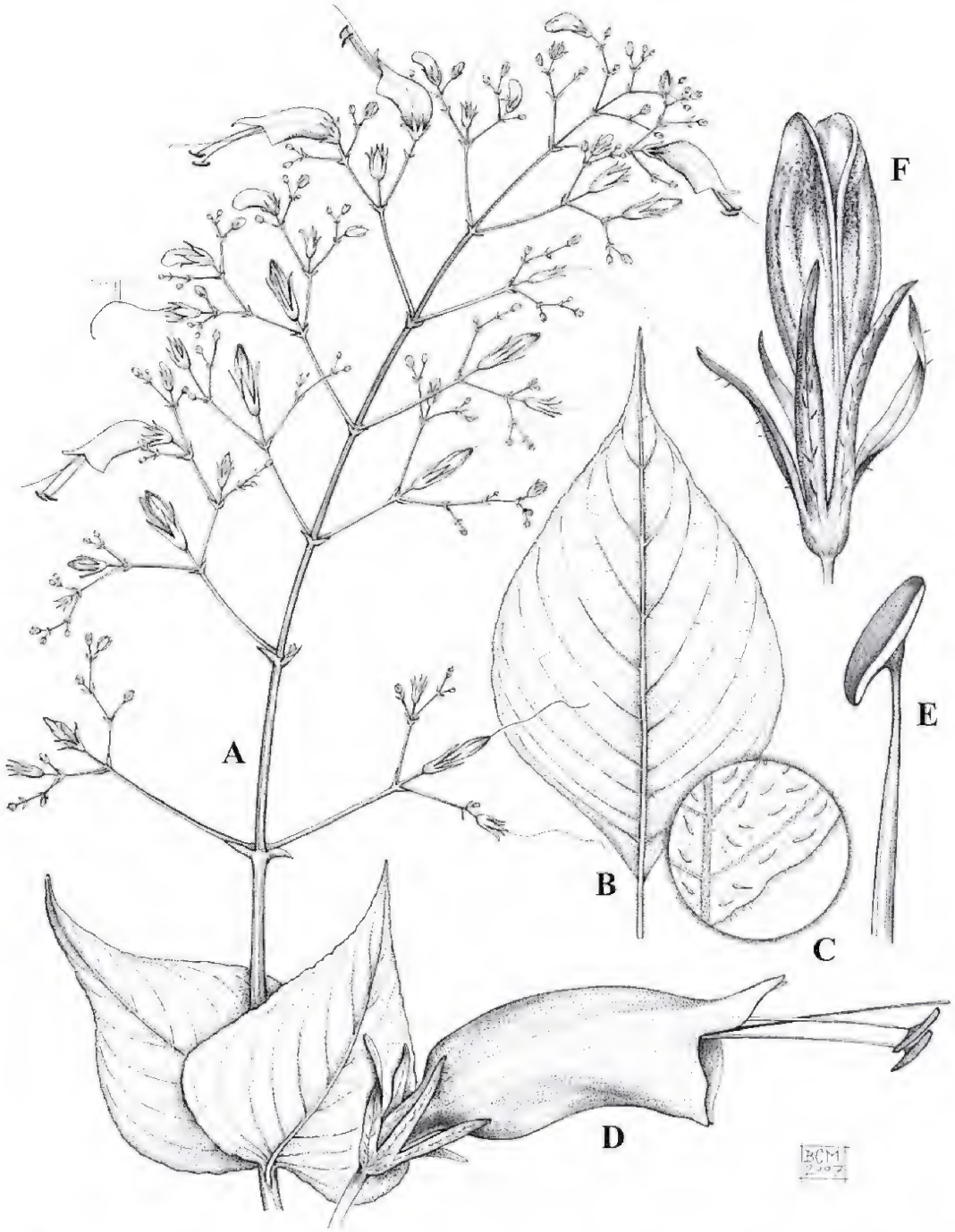


FIGURE 13. *Stenostephanus monolophus* (*Breedlove & Almeda 64849*). A. Habit, × 0.7. B. Proximal leaf, × 0.5. C. Adaxial surface of leaf, × 5. D. Flower, × 2.7. E. Distal portion of stamen with anther, × 7. F. Capsule, × 4.5. Drawn by B. Mendoza.

to lacking stipitate glandular trichomes (e.g., *Molina R. & Molina 26674*). One of these less glandular forms (*Vaght 301* from Quetzaltenango) was referred to the morphologically similar species, *Stenostephanus glaber* (Leonard ex Lundell) T.F. Daniel, by Gibson (1974; as *Hansteinia glabra*). Examination of *Vaght 301* at US reveals it to have diagnostic characters of *S. monolophus* (e.g., dorsally red and ventrally yellow corollas). Thus, the known distribution of *S. glaber* is restricted to Chiapas, Mexico. Daniel (1999c) provided a description and Lundell (1941) provided an illustration of the latter species. It might be expected to occur in Guatemalan cloud forests, and can be readily distinguished from *S. monolophus* by its bicolored corolla that is white distally and red or dark reddish purple proximally.

***Stenostephanus ruberrimus* (D.N. Gibson) T.F. Daniel, comb. nov.**

Habracanthus ruberrimus D.N. Gibson, Fieldiana, Bot. 34:62. 1972. **Type.**— GUATEMALA. **Alta Verapaz**: between Chamá and Cobán, 1500 ft., 15 Aug 1920, *H. Johnson 491* (holotype: F!; isotype: US!).

Shrubs to 2.5 m tall. Young stems subterete to subquadrate, bifariously pubescent (sometimes ± inconspicuously so) with antrorse to antrorsely appressed eglandular trichomes 0.1–0.3 mm long, sometimes soon glabrate. Leaves petiolate, petioles to 70 mm long, blades ovate-elliptic to elliptic, (40–) 65–225 mm long, (11–) 21–77 mm wide, 2.7–4.2 times longer than wide, acuminate to caudate-falcate at apex, attenuate at base, abaxial surface glabrous, adaxial surface with antrorse to antrorsely appressed eglandular trichomes along major veins (or restricted to midvein), margin entire to subcrenate, ciliate. Inflorescence of terminal sessile to pedunculate thyrses to 260 mm long (including peduncle, if present), peduncle and rachis ± flattened to ridge-angled, ± inconspicuously bifariously pubescent with antrorse to antrorsely appressed eglandular trichomes 0.05–0.2 mm long; dichasia opposite, (1–) 3–many-flowered, pedunculate, peduncles 3–13 mm long, pubescent with trichomes like those of rachis. Bracts subulate, 1–3.5 long, 0.4–0.8 mm wide, abaxial surface glabrous or with a few trichomes like those of rachis. Bracteoles subulate, 0.8–2 mm long, 0.3–0.7 mm wide, glabrous or pubescent like bracts. Flowers pedicellate, pedicels 1.5–3 mm long, pubescent like rachis, lateral flowers borne on secondary peduncles 4–9 mm long. Calyx (2.5–) 4.5–6 mm long, abaxially glabrous, lobes subulate, (2–) 4–5.2 mm long, subequal in length, (0.3–) 0.7–0.9 mm wide, margin ciliolate. Corolla (sublinear to) c-shaped in bud, red, 25–36 mm long, externally papillose with papillae less than 0.05 mm long, tube 14–16 mm long, gradually to ± abruptly expanded into a throat, narrow proximal portion 5–7 mm long, throat 8–10 mm long, 3–4.5 mm in diameter near midpoint, upper lip straightforward to spreading-erect, strap-shaped, 13.5–23 mm long, 0.7–2 mm wide, lower lip straightforward to recurved, 3-lobed, 13.5–18 mm long, 5–6 mm wide, lobes 0.5–2 mm long, 0.3–0.6 mm wide. Stamens inserted near base of throat, 23–35 mm long, thecae red, 2.8–4 mm long; pollen globose-elliptic, 2-porate, surface of circular regions sparsely gemmate, peripheral band apparently continuous, gemmate. Style red, 31–50 mm long, stigma 0.1 mm long. Capsule 13–16 mm long, glabrous. Seeds (immature) 3 mm long, covered with subconic tubercles.

Phenology.— Flowering: March, July–September; fruiting: December.

Habitats.— Rain forests, tall forests, moist broadleaf forests; 455–1550 m.

Alta Verapaz: *Johnson 491* (type, see above). **Huehuetenango**: *Garcia et al. 2116* (USCG). **Petén**: *Contreras 6621* (F, LL, MO, S, US). **Quiché**: *Ávila et al. 3058* (USCG).

Gibson (1972, 1974) treated this species under the basionym, *Habracanthus ruberrimus*, and provided an illustration of it. *Stenostephanus ruberrimus* is endemic to Guatemala where it is known from four departments. It is known by at least 10 collections (most of them recent), and was collected as recently as 2006 in Huehuetenango and Quiché.

***Tetramerium nemorum* Brandegee**

RECENT DESCRIPTIONS.— Daniel (1986, 1995b).

PHENOLOGY.— Flowering: November–February; fruiting: November–February.

HABITATS.— Tropical deciduous forest-oak forest transitions, tropical deciduous forests, thornscrub, dry thickets, ravines; 120–1200 m.

Chiquimula: *Véliz & Cobar 13086* (BIGU). **El Progreso**: *Daniel et al. 11214* (BIGU, CAS, K, MICH, MO). **Jutiapa**: *Morales 3542* (USCG). **Retalhuleu:** *Standley 66612* (holotype of *Averia serrata* Leonard: F; isotypes: NY, US). **Zacapa**: *Steyermark 42157* (CAS, F, US).

Gibson (1974) treated this species as *Averia longipes* (Standl.) Leonard, a taxonomic synonym (see Daniel 1986, 1995b).

***Tetramerium nervosum* Nees**

RECENT DESCRIPTIONS.— Daniel (1986, 1995b, 1997b, 1999a), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: August–April; fruiting: August–April.

HABITATS.— Broadleaf forests, tropical deciduous forests, tropical subdeciduous forests, moist thickets, dry thickets, dry and brushy slopes, ravines, disturbed sites (e.g., agricultural lands, roadsides); 120–1500 m.

LOCAL NAME.— "Hierba de coche" (*Molina R. & Molina 26723*)

Alta Verapaz: *Tejada 95* (USCG). **Baja Verapaz**: *Molina R. & Molina 27811* (F). **Chiquimula**: *Molina R. & Molina 25143* (CAS, F). **El Progreso**: *Daniel et al. 11212* (BIGU, CAS, MO). **Escuintla**: *Standley 61324* (F). **Guatemala**: *Standley 89417* (F). **Huehuetenango**: *Molina R. et al. 30173* (F, MO). **Jutiapa**: *Standley 77635* (F). **Quiché**: *Standley 62507* (F). **Zacapa**: *Williams et al. 41869* (F, MO).

Color of corollas among Guatemalan plants varies from yellow to white, with purplish markings on the upper lip.

***Tetramerium tenuissimum* Rose**

RECENT DESCRIPTIONS.— Daniel (1986, 1995b), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: December; fruiting: December.

HABITAT.— Thickets; 150–900 m.

Santa Rosa: *Standley 79509* (F, US).

This species was first noted to occur in Guatemala by Daniel (1986). Although it has not been recollected in the country recently, it likely persists in dry associations. *Tetramerium tenuissimum* is both widespread and sometimes abundant in other portions of its range.

***Thunbergia alata* Bojer ex Sims**

RECENT DESCRIPTIONS.— Daniel (1995b, 1999a), Daniel and Acosta C. (2003).

PHENOLOGY.— Flowering: January–April, September–October; fruiting: January–April, October.

HABITATS.— Thickets, disturbed sites; 5–1600 m.

Alta Verapaz: *Standley 69462* (F). **Escuintla**: *Standley 63383* (F). **Guatemala**: *Aguilar 362* (F). **Izabal**: *Steyermark 42073* (F, US). **Jutiapa**: *Heyde & Lux 6365* (US). **Petén**: *Lundell 1598* (F). **Quezaltenango**: *Tonduz & Rojas 164* (AGUAT, US). **Quiché**: *Aguilar 870* (F). **Sacatepéquez**: *McCarry 130* (TEX). **San Marcos**: *Steyermark 52312* (F). **Santa Rosa**: *Standley 77786* (F). **Sololá**: *Pöll s.n.* 5 X 1991 (UVAL). **Suchitepéquez**: *Shannon 163* (US).

Gibson (1974) noted that this species, native to Africa, is commonly cultivated and naturalized in some regions. She reported its occurrence in Retalhuleu, but no collections from that department

were located during this study. Both yellow- and white-flowered forms have been collected in Guatemala.

***Thunbergia fragrans* Roxb.**

Recent descriptions.— Daniel (1995b), Daniel and Acosta C. (2003).

Phenology.— Flowering: December–January, April, July; fruiting: January, April, July.

Habitats.— Disturbed sites (e.g., roadsides, gardens, hedges, fencerows); 5–500 m.

Izabal: *Daniel et al. 11234* (BIGU, CAS). **Petén**: *Aguilar H. 375* (F). **Retalhuleu**: *Steyermark 34519* (F).

Gibson (1974) noted that this species, native to India, is both cultivated and naturalized in Guatemala. The collections cited above represent naturalized occurrences (*Daniel et al. 11234*) or were not specifically noted to have been cultivated (other collections).

***Thunbergia grandiflora* Roxb.**

Recent Description.— Daniel (1995b).

Phenology.— Flowering: January–February; fruiting: January.

Habitat.— Disturbed sites; brushy slopes; 72–150 m.

Izabal: *Standley 72204* (F).

Gibson (1974) noted that this species, native to Asia, is somewhat commonly cultivated in Guatemala and rarely becomes naturalized there. Standley's collection from near Quiriguá in Izabal indicated that plants were cultivated and naturalized on a brushy slope. The very similar eastern Asian species, *T. laurifolia* Lindl., is cultivated in Guatemala. It differs by its narrower (2.3–3.5 × longer than wide) leaf blades that have only three major veins, a rounded to subcuneate base, and an entire to subsinuate margin.

Excluded Species

Hemigraphis alternata (Burm. f.) T. Anders. This cultivated species has been reported as an escape in Belize, but not in Guatemala (where it is likely cultivated).

Justicia barbata Bertol. Gibson (1974) indicated that the description of this species was suggestive of *J. breviflora*. An image of the type at BOLO reveals a plant that likely does not pertain to Acanthaceae, but rather to *Lamorouxia* or a similar genus of Scrophulariaceae.

Justicia corymbulosa Bertol. According to Gibson (1974) this is a synonym of *Odontonema callistachyum*. Gibson's concept of that species was very broad and several species she treated as conspecific with it are now recognized as distinct. Among these (e.g., *O. callistachyum*, *O. cuspidatum*, *O. tubaeforme*, and *O. steyermarkii*) it remains uncertain to which species this name applies. Based on an image of the type, it appears much like *O. steyermarkii* (e.g., with pecunculate dichasia that are expanded with secondary peduncles).

Justicia ensiflora (Standl.) D.N Gibson. Gibson (1974) included this species from Belize, and Daniel (2005) mistakenly attributed it to Guatemala as well. Although the species likely occurs (or occurred) in Guatemala, I have seen no records substantiating its existence there.

Justicia reptans Sw. Gibson (1974) noted that the Guatemalan specimen attributed to this species (*Steyermark 45813* at F and US) was in poor condition and contained no corollas. Determination of Steyermark's collection was made by Standley; Gibson (1974) stated that the plants indeed appear much like West Indian collections of the species. Examination of Steyermark's specimen (Alta Verapaz: along Río Sebol, to junction with Río Santa Isabel, 125–150 m, 20 Apr 1942) reveals that it is indeed nearly sterile and in poor condition. Collection notes indicate that

the plants were "forming large beds on gravelly place along stream and in middle of stream, either submerged by 1–2 ft. of water or on surface of gravel just above level of water." While the plants show some similarities to subaquatic *J. reptans* (endemic to Santo Domingo and Cuba), it also appears similar to both *J. comata* and *J. pectoralis*, both of which are also frequently subaquatic and both of which occur in Guatemala. In the totality of characters present (e.g., vegetative pubescence; bracteoles less than 1 mm long; and calyx 2 mm long with 5 equal lobes), it appears more like *J. comata*. It differs most notably from that species by lacking whorled inflorescence branches. Although a photo of pollen attached to the specimen is labeled as *J. reptans* and shows 2-aperturate grains with the apertures flanked by one row of insulae on each side (much like *J. comata*), it must be questioned whether the grain pertains to the specimen since Gibson had noted that corollas were not present on it. Because she described both corollas and capsules (presumably from West Indian material), the pollen photo probably pertains to a plant other than *Steyermark 45813*.

Stenostephanus glaber (Leonard ex Lundell) T.F. Daniel. Gibson (1974) noted the occurrence of this species, as *Hansteinia glabra* (Leonard) D.N. Gibson, in Guatemala based on *Vaght 301* from Quetzaltenango. This collection is here treated under *S. monolophus*.

Stenostephanus silvaticus (Nees) T.F. Daniel. Gibson (1974; as *Habracanthus silvaticus* Nees) indicated that although this species had not been collected in Guatemala it might be expected to occur there. No Guatemalan collections of this rather common and widely distributed (Mexico to Panama) species have been located in the years since Gibson's account. Several plants labeled with synonyms of this name are referable to other species. It remains very likely that it will be located eventually in moist to wet montane forests of Guatemala.

Thunbergia erecta (Benth.) T. Anders. This cultivated species was listed by Gibson (1974); it is not known to be naturalized in Guatemala.

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Literature Cited

Acosta C., S. and A. Saynes V. 2006. Una nueva variedad de *Lophostachys guatemalensis* (Acanthaceae) de interesante distribución geográfica. *Novon* 16:449–451.

Baum, V.M. 1982. A revision of the genus *Odontonema* (Acanthaceae). Unpublished M.S. Thesis, University of Maryland, College Park, Maryland, USA.

BENNET, S.S.R. AND S. CHANDRA. 1982. Two new names in *Justicia* L. *Journal of Economic and Taxonomic Botany* 3:602.

BONIS, S., O.H. BOHNENBERGER, AND G. DENGO. 1975. Mapa Geológico de la República de Guatemala, 2a impresión. Instituto Geográfico Nacional, Cd. Guatemala.

CASTAÑEDA, C. 2008. Diversidad de ecosistemas en Guatemala. Pages 181–229 *in* C. Azurdia P. et al., eds., *Guatemala y su Biodiversidad: Un Enfoque Histórico, Cultural, Biológico y Económico*. Consejo Nacional de Áreas Protegidas, Oficina Técnica de Biodiversidad, Cd. Guatemala.

CHEATHAM, S., M.C. JOHNSTON, L. MARSHALL, AND J. SUBLETT. 2000. *The Useful Wild Plants of Texas*, vol. 2. Useful Wild Plants, Inc. Austin, Texas, USA. 599 pp.

CONAP. 2006. *Lista de Especies Amenazadas de Guatemala*. Consejo Nacional de Áreas Protegidas. Cd. Guatemala. 58 p. [*<http://74.125.155.132/search?q=cache:C0Y-f_hQMVUJ:conap.gob.gt:7778/conap/documentos/fauna/Listado%2520de%2520especies%2520amenazadas.pdf+lista+de+especies+amenazadas+de+flora+silvestre+de+guatemala&cd=3&hl=en&ct=clnk&gl=us>*]. Accessed on 29 June 2009.

CONAP. 2007. Sistema Guatemalteco de Areas Protegidas (map). Consejo Nacional de Áreas Protegidas. [*<http://conap.gob.gt:7778/conap/areas-protegidas/sigap/mapas-tematicos/>*] Accessed on 1 July 2009.

CORRELL, D.S. AND H.B. CORRELL. 1982. *Flora of the Bahama Archipelago*. J. Cramer, Vaduz. 1692 pp.

COWAN, C.P. 1983. *Listados Floristicos de México I. Flora de Tabasco*. Instituto de Biología, Universidad Nacional Autónoma de México, Cd. México. 123 pp.

DANIEL, T.F. 1983. *Carlowrightia* (Acanthaceae). *Flora Neotropica* 34:1–116.

DANIEL, T.F. 1985. A revision of *Stenandrium* (Acanthaceae) in Mexico and adjacent regions. *Annals of the Missouri Botanical Garden* 71:1028–1043.

DANIEL, T.F. 1986. Systematics of *Tetramerium* (Acanthaceae). *Systematic Botany Monographs* 12:1–134.

DANIEL, T.F. 1988. A systematic study of *Bravaisia* DC. (Acanthaceae). *Proceedings of the California Academy of Sciences*, ser. 4, 45:111–132.

DANIEL, T.F. 1990a. Systematics of *Henrya* (Acanthaceae). *Contributions from the University of Michigan Herbarium* 17:99–131.

DANIEL, T.F. 1990b. New and reconsidered Mexican Acanthaceae. IV. *Proceedings of the California Academy of Sciences*, ser. 4, 46:279–287.

DANIEL, T.F. 1990c. New, reconsidered, and little-known Mexican species of *Ruellia* (Acanthaceae). *Contributions from the University of Michigan Herbarium* 17:139–162.

DANIEL, T.F. 1991a. A revision of *Aphelandra* (Acanthaceae) in Mexico. *Proceedings of the California Academy of Sciences*, ser. 4, 47:235–274.

DANIEL, T.F. 1991b. A synopsis of *Poikilacanthus* (Acanthaceae) in Mexico. *Bulletin of the Torrey Botanical Club* 118:451–458.

DANIEL, T.F. 1992. Acanthaceae: Mendoncioideae of Mexico. *Acta Botánica Mexicana* 17:53–60.

DANIEL, T.F. 1993a. A synopsis of *Lophostachys* (Acanthaceae) in Mexico and Central America. *Selbyana* 14:64–70.

DANIEL, T.F. 1993b. Taxonomic and geographic notes on Central American Acanthaceae. *Proceedings of the California Academy of Sciences*, ser. 4, 48:119–130.

DANIEL, T.F. 1993c. New and reconsidered Mexican Acanthaceae. V. *Contributions from the University of Michigan Herbarium* 19:271-291.

DANIEL, T.F. 1995a. New and reconsidered Mexican Acanthaceae. VI. Chiapas. *Proceedings of the California Academy of Sciences*, ser. 4, 48:253–284.

DANIEL, T.F. 1995b. Acanthaceae. Pages 1–158 *in* D.E. Breedlove, ed., *Flora of Chiapas*, pt. 4, California Academy of Sciences, San Francisco.

DANIEL, T.F. 1995c. Revision of *Odontonema* (Acanthaceae) in Mexico. *Contributions from the University of Michigan Herbarium* 20:147–171.

DANIEL, T.F. 1997a. Catalog of the Acanthaceae of Belize with taxonomic and phytogeographic notes. *Contributions from the University of Michigan Herbarium* 21:161–174.

DANIEL, T.F. 1997b. The Acanthaceae of California and the peninsula of Baja California. *Proceedings of the California Academy of Sciences*, ser. 4, 49:309–403.

DANIEL, T.F. 1998. Pollen morphology of Mexican Acanthaceae: diversity and systematic significance. *Proceedings of the California Academy of Sciences*, ser. 4, 50:217–256.

DANIEL, T.F. 1999a. Acanthaceae. Pages 1–102 *in* P.D. Dávila A. et al., eds., *Flora del Valle de Tehuacán-Cuicaltán*, fascículo 23. Universidad Nacional Autónoma de México, México.

DANIEL, T.F. 1999b. Revision of *Spathacanthus* (Acanthaceae). *Contributions from the University of Michigan Herbarium* 22:33–46.

DANIEL, T.F. 1999c. Revision of *Stenostephanus* (Acanthaceae) in Mexico. *Contributions from the University of Michigan Herbarium* 22:47–93.

DANIEL, T.F. 2001. Catalog of Acanthaceae in El Salvador. *Contributions from the University of Michigan Herbarium* 23:115–137.

DANIEL, T.F. 2003. A reconsideration of *Megalostoma* (Acanthaceae), a new species, and recognition of a new section of *Justicia*. *Proceedings of the California Academy of Sciences*, ser. 4, 54:371–380.

DANIEL, T.F. 2004a. A synopsis of *Justicia* section *Mesoamericanae* (Acanthaceae). *Proceedings of the California Academy of Sciences*, ser. 4, 55:174–183.

DANIEL, T.F. 2004b. Acanthaceae of Sonora: taxonomy and phytogeography. *Proceedings of the California Academy of Sciences*, ser. 4, 55:690–805.

DANIEL, T.F. 2004c. Further range extensions of Mexican Acanthaceae. *Polibotanica* 18:1–12.

DANIEL, T.F. 2005. Catalog of Honduran Acanthaceae with taxonomic and phytogeographic notes. *Contributions from the University of Michigan Herbarium* 24:51–108.

DANIEL, T.F. 2006. Synchronous flowering and monocarpy suggest plietesial life history for Neotropical *Stenostephanus chiapensis* (Acanthaceae). *Proceedings of the California Academy of Sciences*, ser. 4, 57:1011–1018.

DANIEL, T.F. 2007. New *Justicia* (Acanthaceae) from southern Mexico and Guatemala. *Contributions from the University of Michigan Herbarium* 25:179–189.

DANIEL, T.F. 2008 ("2007"). Notes on the distributions of some Mexican Acanthaceae. *Ibugana* 15:13–22.

DANIEL, T.F. 2009. Synopsis of *Dicliptera* (Acanthaceae) in the Nueva Galicia region of western Mexico with a new species, *D. novogaliciana*. *Proceedings of the California Academy of Sciences*, ser. 4, 60:1–18.

DANIEL, T.F. AND S. ACOSTA C. 2003. Acanthaceae. Pages 1–173 *in* J. Rzedowski and G. Calderón de Rzedowski, eds., *Flora del Bajío y de Regiones Adyacentes*, fascículo 117. Instituto de Ecología, Pátzcuaro.

DANIEL, T.F. AND E. FIGUEIREDO. 2009. The California Academy of Sciences Gulf of Guinea Expeditions (2001, 2006, 2008) VII. Acanthaceae of São Tomé and Príncipe. *Proceedings of the California Academy of Sciences*, ser. 4, 60:623–674.

DANIEL, T.F. AND M. VÉLIZ P.. 2009. *Justicia sangilensis*, a new species of Acanthaceae from Guatemala. *Proceedings of the California Academy of Sciences*, ser. 4, 60:455–459.

DAVIS, S. D., S.J.M. DROOP, P. GREGERSON, L. HENSON, C.J. LEON, J.L. VILLA-LOBOS, H. SYNGE, AND J. ZANTOVSKA. 1986. *Plants in Danger: What Do We Know?* International Union for Conservation of Nature and Natural Resources, Gland, Switzerland. 461 pp.

DIX, M.A. 1997. Sierra de Las Minas region and biosphere reserve. Pages 193–197 *in* S.D. Davis et al., eds., *Centres of Plant Diversity*, vol. 3. World Wide Fund for Nature, Cambridge, England.

DURKEE, L.H. 1978. Acanthaceae. Pages 155–283 *in* R.E. Woodson et al., eds., Flora of Panama, *Annals of the Missouri Botanical Garden* 65. Missouri Botanical Garden, St. Louis, Missouri, USA.

DURKEE, L.H. 1986. Acanthaceae. Pages 1–87 *in* W. Burger, ed., Flora Costaricensis, *Fieldiana, Botany* 18. Field Museum of Natural History, Chicago, Illinois, USA.

DURKEE, L.H. 2001. Acanthaceae. Pages 8–36 in W.D. Stevens et al., eds., Flora de Nicaragua, *Monographs in Systematic Botany from the Missouri Botanical Garden* 85(1). Missouri Botanical Garden, St. Louis, Missouri, USA.

EZCURRA, C. 2002. El género *Justicia* (Acanthaceae) en sudamérica austral. *Annals of the Missouri Botanical Garden* 89:225–280.

FOURNET, J. 2002. *Flore Illustrée des Phanérogames de Guadeloupe et de Martinique* (revised edition, 2 vols.). Gondwana Editions, Montpellier, France. 2538 pp.

GIBSON, D.N. 1970. Verbenaceae. Pages 167–236 *in* P.C. Standley et al., eds., Flora of Guatemala, *Fieldiana, Botany* 24, pt. 9. Field Museum of Natural History, Chicago, Illinois, USA.

GIBSON, D.N. 1972. Studies in American plants, III. *Fieldiana, Botany* 34:57–87.

GIBSON, D.N. 1974. Acanthaceae. Pages 328–461 *in* P.C. Standley et al., eds., Flora of Guatemala, *Fieldiana, Botany* 24, pt. 10. Field Museum of Natural History, Chicago, Illinois, USA.

GOOMBRIDGE, B. AND M.D. JENKINS. 2002. *World Atlas of Biodiversity*. University of California Press, Berkeley, California, USA. 340 pp.

GRAHAM, V.A.W. 1988. Delimitation and infra-generic classification of *Justicia* (Acanthaceae). *Kew Bulletin* 43:551–624.

HILSENBECK, R.A. 1989. A new species of *Siphonoglossa* (Acanthaceae) and some infrageneric transfers. *Madroño* 36:198–207.

ISLEBE, G.A. AND A.M. CLEEF. 1995. Alpine plant communities of Guatemala. *Flora* 190:79–87.

IUCN. 2009. IUCN Red List of Threatened Species, version 2009.1. [<*www.iucnredlist.org*>]. Accessed on 16 June 2009.

JARVIS, C. 2007. *Order out of Chaos: Linnaean Plant Names and their Types*. The Linnean Society of London, London, UK. 1016 pp.

KAMEYAMA, C. 2008. New species, nomenclatural changes and lectotypifications in Neotropical *Lepidagathis* Willd. (Acanthaceae). *Kew Bulletin* 63:565–581.

LEONARD, E.C. 1941. New Acanthaceae from Guatemala. *Journal of the Washington Academy of Sciences* 31:96–105.

LEONARD, E.C. 1951. The Acanthaceae of Colombia, I. *Contributions from the United States National Herbarium* 31(1):1–116.

LUNDELL, C.L. 1941. Studies of American spermatophytes–I. *Contributions from the University of Michigan Herbarium* 6:3–66.

MACVEAN, A.L. 2006. *Plantas Útiles de Sololá*. Universidad del Valle de Guatemala, Guatemala. 222 pp.

MACVEAN, A.L. DE AND G. DAVIDSE. 2007. ¿Dónde debemos colectar plantas en Guatemala? *Revista de la Universidad del Valle de Guatemala* 16:150–165.

MAGA. 2001. Mapa de Zonas de Vida de Holdridge, República de Guatemala. Ministerio de Aguicultura, Ganadería y Alimentación, Cd. Guatemala. [<*http://conap.gob.gt:7778/conap/areas-protegidas/sigap/mapas-tematicos*>]. Accessed on 1 July 2009.

MCDADE, L.A., T.F. DANIEL, AND C.A. KIEL. 2008. Toward a comprehensive understanding of phylogenetic relationships among lineages of Acanthaceae s.l. (Lamiales). *American Journal of Botany* 95:1136–1152.

MCNEILL, J. ET AL. 2006. *International Code of Botanical Nomenclature (Vienna Code)*. A.R.G. Gantner Verlag KG: Ruggell, Liechtenstein. 568 pp.

MOLDENKE, H.N. 1960. Materials toward a monograph of the genus *Avicennia*. I. *Phytologia* 7:123–168.

PARKER, T. 2008. *Trees of Guatemala*. The Tree Press, Austin, Texas, USA. 1033 pp.

POOL, A. 2001. *Avicennia* L. Pages 2503–2504 *in* W.D. Stevens et al., eds., Flora de Nicaragua, *Monographs in Systematic Botany from the Missouri Botanical Garden* 85(3). Missouri Botanical Garden, St. Louis, Missouri, USA.

RADLKOFER, L. 1883. Ueber den systematischen Werth der Pollenbeschaffenheit bei den Acanthaceen. *Sitzungsberichte der mathematisch-physikalischen Classe der Königlichen Bayerischen Akademie der Wissenschaften zu München* 13(2):256–314.

RUSBY, H.H. 1893. On the collections of Mr. Miguel Bang in Bolivia. *Memoirs of the Torrey Botanical Club* 3(3):1–67.

RUSBY, H.H. 1895. An enumeration of the plants collected in Bolivia by Miguel Bang, with descriptions of new genera and species: on the collections of Mr. Miguel Bang in Bolivia.–Part II. *Memoirs of the Torrey Botanical Club* 4:203–274.

SCHWARZBACH, A.E. AND L.A. MCDADE. 2002. Phylogenetic relationships of the mangrove family Avicenniaceae based on chloroplast and nuclear ribosomal DNA sequences. *Systematic Botany* 27:84–98.

STANDLEY, P.C. AND J.A. STEYERMARK. 1947. Studies of Central American Plants–VII. *Publications of the Field Museum of Natural History, Botanical Series* 23:195–256.

STEARN, W.T. 1958. A key to West Indian mangroves. *Kew Bulletin* 1958:33–37.

STEYERMARK, J.A. 1950. Flora of Guatemala. *Ecology* 31:368–372.

TOMLINSON, P.B. 1986. *The Botany of Mangroves*. Cambridge University Press, Cambridge, UK. 413 pp.

Tripp, E.A., T.F. Daniel, J.C. Lendemer, and L.A. McDade. 2009. New molecular and morphological insights prompt transfer of *Blechum* to *Ruellia* (Acanthaceae). *Taxon* 58:893–906.

Véliz P., M.E. 2002. El bosque seco y monte espinoso de Guatemala. Pages 62–69 *in Ecosistemas Forestales de Bosque Seco Tropical: Investigaciones y Resultados en Mesoamerica*. Universidad Nacional Costa Rica, Heredia. 244 pp.

Véliz P., M.E. 2008. Diversidad florística de Guatemala. Pages 261–299 *in* C. Azurdia P. et al., eds., *Guatemala y su Biodiversidad: Un Enfoque Histórico, Cultural, Biológico y Económico*. Consejo Nacional de Áreas Protegidas, Oficina Técnica de Biodiversidad, Cd. Guatemala.

Walter, K.S. and H.J. Gillett, eds. 1998. *1997 IUCN Red List of Threatened Plants*. International Union for Conservation of Nature and Natural Resources, World Conservation Monitoring Centre, Gland, Switzerland. 862 pp.

Wasshausen, D.C. and J.R.I. Wood. 2004. Acanthaceae of Bolivia. *Contributions from the United States National Herbarium* 49:1–152.

Appendix I

Taxonomic Placement of Genera of Acanthaceae Native to Guatemala

Phylogenetic relationships among the subfamilies and tribes can be summarized as follows: Nelsonioideae [{Thunbergioideae + *Avicennia*}{Acantheae(Barlerieae(Justicieae + Ruellieae))}]. Although analyses reveal *Avicennia* to be nested among Acanthaceae, its precise placement has yet to be determined. Inclusion as sister to genera of Thunbergioideae is likely, but possible placement as distinct from that subfamily and sister to Acanthoideae has not been rejected (McDade et al. 2008).

Subfamily Acanthoideae

Tribe Acantheae
Aphelandra, *Stenandrium*

Tribe Barlerieae
Barleria, *Lepidagathis*

Tribe Justicieae
Carlowrightia, *Chileranthemum*, *Dicliptera*, *Henrya*, *Justicia*, *Odontonema*, *Poikilacanthus*, *Pseuderanthemum*, *Razisea*, *Schaueria*, *Spathacanthus*, *Stenostephanus*, *Tetramerium*

Tribe Ruellieae
Bravaisia, *Dyschoriste*, *Hygrophila*, *Louteridium*, *Ruellia*

Subfamily Nelsonioideae
Elytraria

Subfamily Thunbergioideae
Avicennia, *Mendoncia*

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Nitela constructor, a New Species from French Guiana (Hymenoptera: Crabronidae)

Wojciech J. Pulawski
California Academy of Sciences, 55 Music Concourse Drive, Golden Gate Park, San Francisco, California 94118, USA; Email: wpulawski@calacademy.org

The new species *Nitela constructor*, from French Guiana, is characterized by a microareolate frons, an evenly arcuate clypeal free margin, a pale yellow pronotal lobe, a conspicuously expanded episternal sulcus, a propodeal dorsum unsculptured between ridges, black femora, and largely black mid- and hindtibiae.

The objective of this paper is to provide a formal name for an article now in preparation on the nesting habits of this species by Mario X. Ruiz-González, Bruno Corbara, Céline Leroy, Alain Dejean, and Jérôme Orivel. The species has unusual nesting habits: rather than using preexisting cavities, the female builds the nest, mainly from fungal hyphae, on the lower surface of leaves of the undergrowth ant-shrub *Hirtella physophora* Mart. & Zucc. (Chrysobalanaceae).

***Nitela constructor* Pulawski, sp. nov.**

NAME DERIVATION.— The Latin word *constructor* has the same meaning in English and refers to the method of female nest building. It is a noun in apposition to the generic name.

DIAGNOSIS.— Of the 61 species currently recognized in *Nitela*, 16 are known to occur in the Neotropical Region. Eleven of the 16 are members of the *amazonica* species group, formerly treated as the subgenus *Tenila*, and characterized by the presence of a continuous and lamelliform frontoclypeal carina and setose eyes (Bohart and Menke, 1976; van Zuijlen, 1994), clearly derived characters. *N. carinifrons* Menke has a frontoclypeal carina and also a transverse carina on the lower frons, but it lacks the setae on the eyes. The remaining four species: *N. costaricensis* Brauns, 1911 (Costa Rica), *N. darwini* Turner, 1916 (Galápagos Islands), *N. reticulata* Ducke, 1908 (Brazil), and *N. schmidti* Brauns, 1911 (Costa Rica), lack these specializations, as does *Nitela constructor*. Three of them are known from the female sex only, whereas *reticulata* was described from both sexes.

No modern revision exists of these unspecialized species. I was able, however, to examine specimens of *darwini*, and have studied the original descriptions of the remaining three species. This analysis convinced me that *constructor* is indeed undescribed. It differs from *darwini* by a number of characters, the most important of which are the following: frons microareolate (rather than irregularly, longitudinally microridged); clypeal free margin forming single, regularly arcuate line (rather than having a somewhat prominent, laterally angulate lobe); transverse sulcus of pronotal collar unsculptured (rather than with longitudinal carinae); pronotal lobe pale yellow (rather than black); episternal sulcus conspicuously enlarged, almost reaching pronotal lobe (rather than fine, well separated from lobe); mesopleuron finely punctate posteroventrally, aciculate between punctures (rather than finely rugose); and propodeal dorsum unsculptured between ridges (rather than microsculptured). Also, the femora are black in *constructor* (also mid- and hindtibiae are

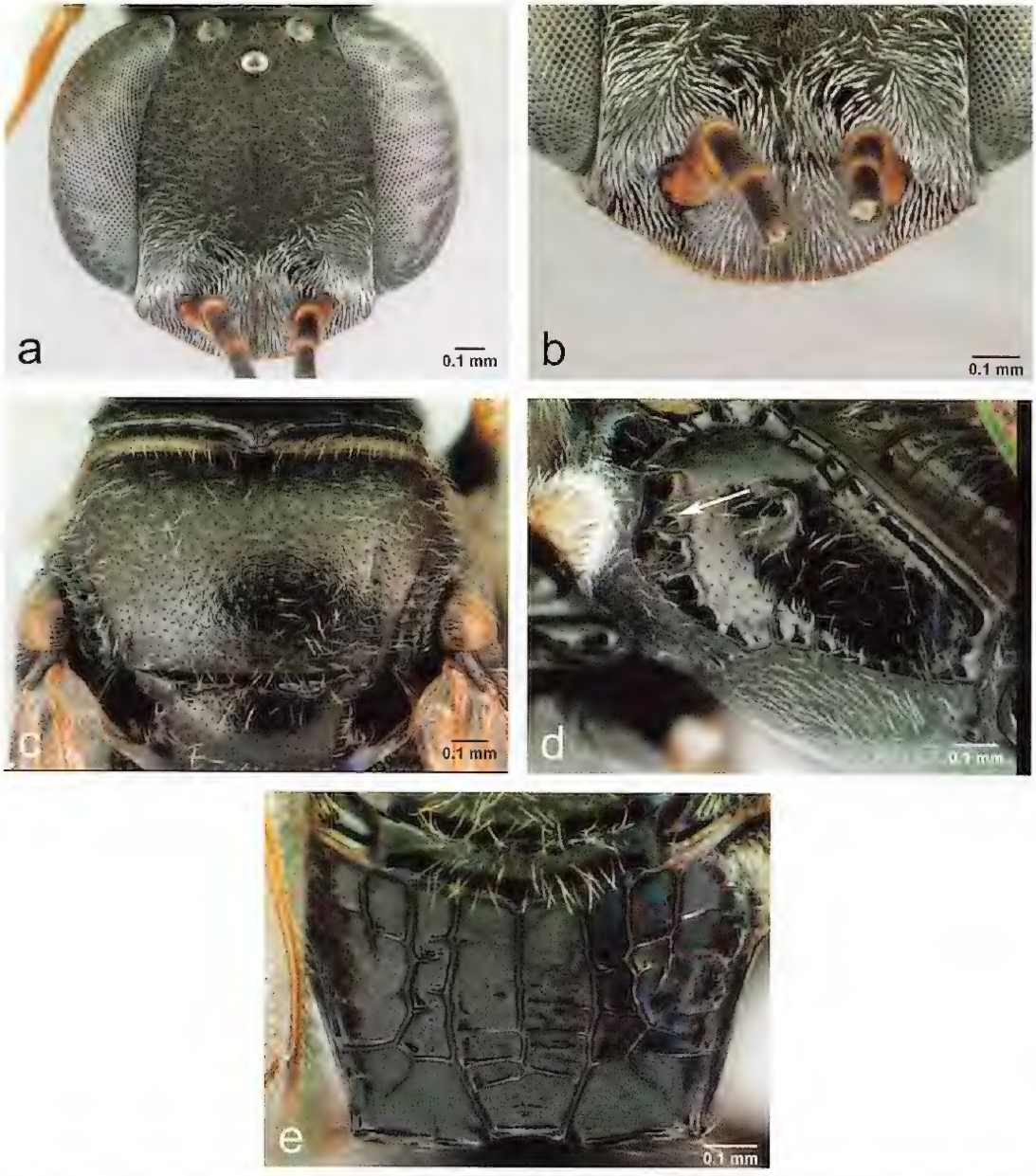

FIGURE 1. *Nitela constructor* Pulawski, sp. nov., holotype female: a – frons in frontal view; b – clypeus in frontal view; c – scutum in dorsal view; d – mesopleuron in lateral view (arrows shows episternal sulcus); e – propodeal dorsum in dorsal view.

largely black), whereas the legs are all red in *schmidti* and largely red in *reticulata*, and the free margin of the clypeal lobe is evenly arcuate in *constructor*, but with a laterally angulate lobe in *schmidti*. Finally, the scape is yellow ventrally and the scutellum is sparsely punctate, whereas the antenna is all black and the scutum is densely punctate in *costaricensis*.

DESCRIPTION (based on holotype only).— ♀: Frons dull, evenly, microscopically areolate, with shallow, minute, barely recognizable punctures. Clypeal free margin evenly arcuate, without

median lobe; clypeal surface with obtuse median carina which attains frontoclypeal suture, but does not quite attain free margin; medioventral clypeal area convex, punctate sparser than remaining surface. Interocular distance posterior to ocelli equal to 0.6 × distance at the level of antennal sockets. Ocellocular distance equal to about 0.5 of hindocellar width, unsculptured except for several minute punctures. Gena as seen in profile markedly narrower than eye, and as seen from above almost absent, not sulcate nor swollen along posterior eye margin. Antennal socket simple. Dorsal length of flagellomere I 2.2 × apical width. Minimum length of malar space about 0.5 of midocellar width. Pronotal collar with transverse sulcus (except mesally), sulcus unsculptured, without longitudinal ridges. Scutum and mesopleuron alutaceous, slightly shiny, with minute punctures that are several diameters apart (less near scutal foremargin), scutum conspicuously foveolate along flange, without longitudinal ridges next to hindmargin. Mesopleuron foveolate along posterior margin; upper part of episternal sulcus (above hypersternaulus) markedly enlarged, containing five longitudinal carinae, almost reaching pronotal lobe, at that point slightly wider than median ocellus width; hypersternaulus less prominent but also conspicuous. Scutellum with four ill-defined pits near anterior margin. Propodeum unsculptured and shiny between ridges; dorsum with several well-defined longitudinal carinae of which only two submedian ones (slightly curving outwards) reach hindmargin; area between submedian carinae with longitudinal carina that ends about midlength of propodeal dorsum, and with several transverse carinae; dorsum posterolaterally with a square area, traversed by a few carinae; margined at border with posterior surface; side ridged; posterior surface transversely ridged, with median carina in ventral half that bifurcates in dorsal half. Terga I and II with microscopic punctures that are several diameters apart and unsculptured interspaces, apical depressions impunctate mesally; punctures on tergum III denser than on I and II, interspaces also unsculptured; terga IV and V with interspaces alutaceous. Length 5.2 mm.

Interocellar area and mesoscutum with suberect setae that are about as long as half midocellar width.

Body black, with the following exceptions: mandible yellowish (black basally), scapal venter yellowish brown, pronotal lobe pale yellow, foretibia and tarsus yellowish brown, mid- and hindtibiae pale yellow basally, mid- and hindtarsi brown. Wings clear, stigma and veins brown.

♂.— Unknown.

Condition of holotype.— Flagellomeres II-X lost on both antennae; left mid- and hindlegs lost.

Geographic distribution.— French Guiana.

Records.— Holotype: ♀, **FRENCH GUIANA**: Petit Saut at 5°02′51″S 52°57′11″W, 25 Oct 2008, Mario X. Ruiz-González (California Academy of Sciences).

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Literature Cited

Bohart, R.M., and A.S. Menke. 1976. *Sphecid Wasps of the World. A Generic Revision.* University of California Press, Berkeley, Los Angeles, California, USA and London, UK. ix + 695 pp., 1 col. pl.

van Zuijlen, J.W.A. 1994. The *amazonica* species group of the genus *Nitela* Latreille (Hymenoptera: Sphecidae: Crabroninae). *Zoologische Mededelingen* (*Leiden*) 68:249–269.

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Discovery of the Eurasian carabid beetle species, *Carabus granulatus* Linnaeus (Coleoptera: Carabidae: Carabini), in the Haida Gwaii (Queen Charlotte Islands) of British Columbia, Canada.

David H. Kavanaugh

Department of Entomology, California Academy of Sciences, 55 Concourse Drive, San Francisco, CA 94118, USA; Email: dkavanaugh@calacademy.org

The European carabid beetle species, *Carabus granulatus* Linnaeus, is recorded for the first time from the Haida Gwaii (Queen Charlotte Islands) of British Columbia, Canada. This species appears to be well established on the southeast coast of Graham Island and can be expected to spread to other parts of that island with habitat disturbance and other human activities.

KEYWORDS: Carabidae, Carabini, *Carabus granulatus* Linnaeus, introduced species, Pacific Northwest fauna, Haida Gwaii, Queen Charlotte Islands.

Carabus granulatus Linnaeus (1758:413), a species native to Eurasia, where it ranges from western Europe to eastern Siberia and Japan, has been introduced inadvertently onto both coasts of North America (Lindroth 1957). Hatch (1933) reported the earliest known West Coast records, from the Seattle, Washington area, beginning in 1924. According to Lindroth (1961), the first record for British Columbia was from Vancouver (Point Grey) in 1926, and, subsequently, the species became more widely distributed in southern portions of that province. In 1992, when I published my treatment (Kavanaugh 1992) of the carabid beetle fauna of the Queen Charlotte Islands, now known as the Haida Gwaii, *C. granulatus* was unknown from that archipelago, despite an intensive collecting effort there in the 1980s and study of all known carabid specimens from the region preserved in North American collections at that time.

In July, 2009, I had the opportunity to revisit the Haida Gwaii for the first time since the 1980s and to resample some of my previous collecting sites. While collecting at about 10:00 pm on the night of 12 July, 10 kilometers north of Skidegate village on the east coast of Graham Island, I was surprised to encounter two adults of *C. granulatus*. Both were found running over stones on the exposed banks of Chinukundl Creek, just above the bridge at Highway 16. Over the next several days, up to and including 22 July, I encountered a total of 10 more adults and one third instar larva of *C. gran-*

FIGURE 1. Digital photograph of *Carabus granulatus* Linnaeus, dorsal aspect, adult male from Chinukundl Creek, Graham Island, Haida Gwaii, British Columbia, Canada; scale line = 2.0 mm. Photo by Victor G. Smith, California Academy of Sciences.

ulatus under boards, cut logs, and stones at various locations around homes and gardens in the Miller Creek subdivision, where I was lodging, just north of the Chinukundl Creek site.

Through discussions with several residents of the subdivision, I learned that this species was well known to them and frequently encountered by them in the course of their routine gardening and yard work activities. *Carabus granulatus* appears to be well established now, at least in this part of Graham Island. Just when this species first arrived on Graham Island is unclear; but I never encountered it during my extensive fieldwork there in the 1980s or in my study of all known specimens from the archipelago in North American collections at that time or since. I suggest that its arrival dates to no earlier than 1986 and probably later than that, and that the nearest and most likely source area for the introduction is the southern British Columbia mainland.

Carabus granulatus represents the third known carabid beetle species native to western Europe that has been introduced into the Haida Gwaii. The other two species are *Carabus nemoralis* Müller and *Trechus obtusus* Erichson (Kavanaugh 1992). Like these species, which also are associated with synanthropic sites, *C. granulatus* can be expected to expand its range on Graham Island in the future, and perhaps also to expand to other islands of the archipelago, with habitat alteration and the spread of human activities.

Acknowledgments

I thank Dr. Carita Bergman, Terrestrial Ecologist with the Gwaii Haanas National Park Reserve and Haida Heritage Site, for her extraordinary assistance prior to and throughout the course of my fieldwork in the Haidi Gwaii in 2009, and particularly for providing me with the lodging at Miller Creek, which directly facilitated the discovery reported here.

References

Hatch, M.H. 1933. Notes on Carabidae. *The Pan-Pacific Entomologist* 9:117-121.

Kavanaugh, D.H. 1992. *Carabid beetles (Coleoptera: Carabidae) of the Queen Charlotte Islands, British Columbia*. Memoirs of the California Academy of Sciences, no. 16. vii + 113 pp.

Lindroth, C.H. 1957. *The Faunal Connections Between Europe and North America*. John Wiley & Sons, New York, New York, USA. 344 pp.

Lindroth, C.H. 1961. *The Ground-beetles of Canada and Alaska*, pt. 2. Opuscula Entomologica, Suppl. 20. 200 pp.

Linnaeus, C. 1758. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Edition decimal, reformata. Tomus I. Laurentii Salvii, Holmiae (Stockholm), Sweden. 823 pp.

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